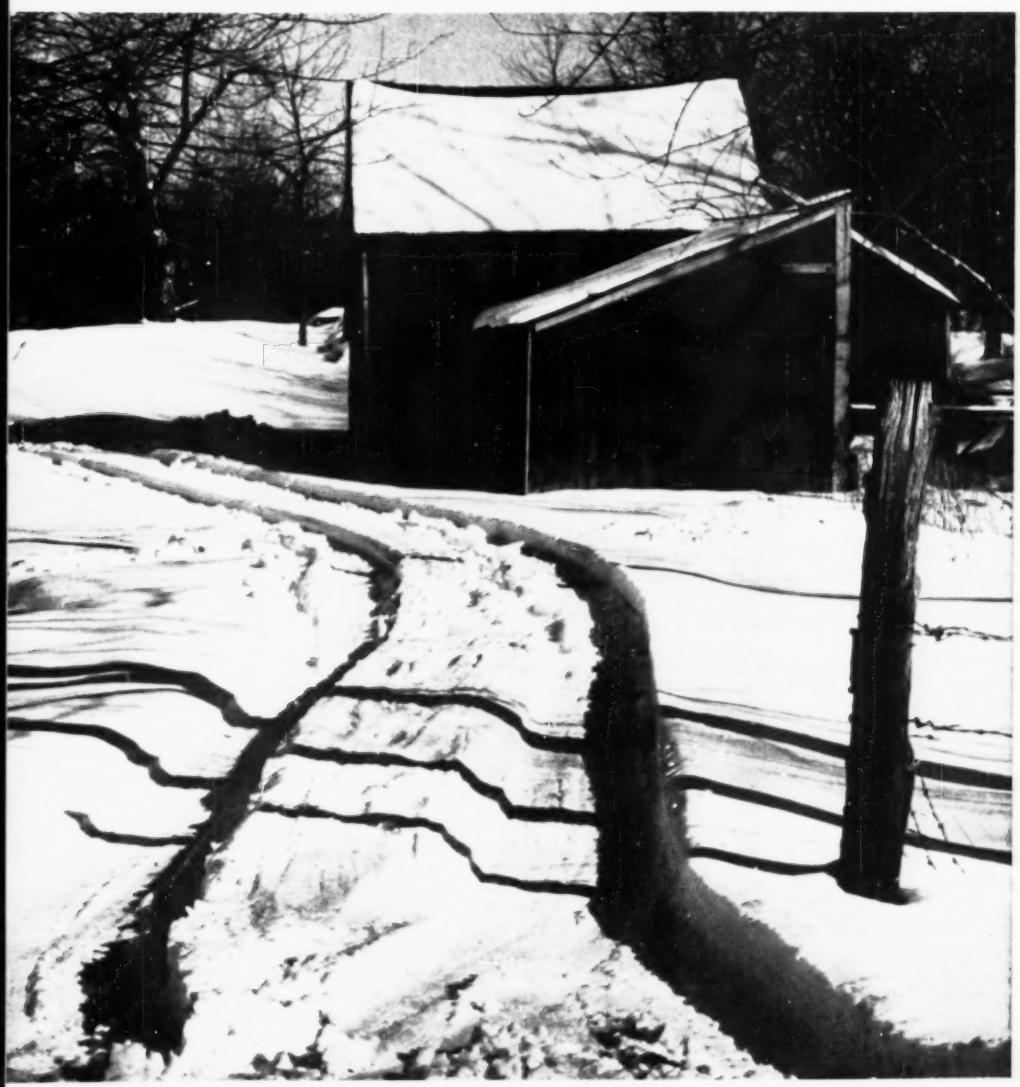
Compressed Air Magazine



DECEMBER 1959

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ST. NICK GOES KARTING
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PNEUMATICS IN THE 1700's
AIR AIDS FILM PROCESSING
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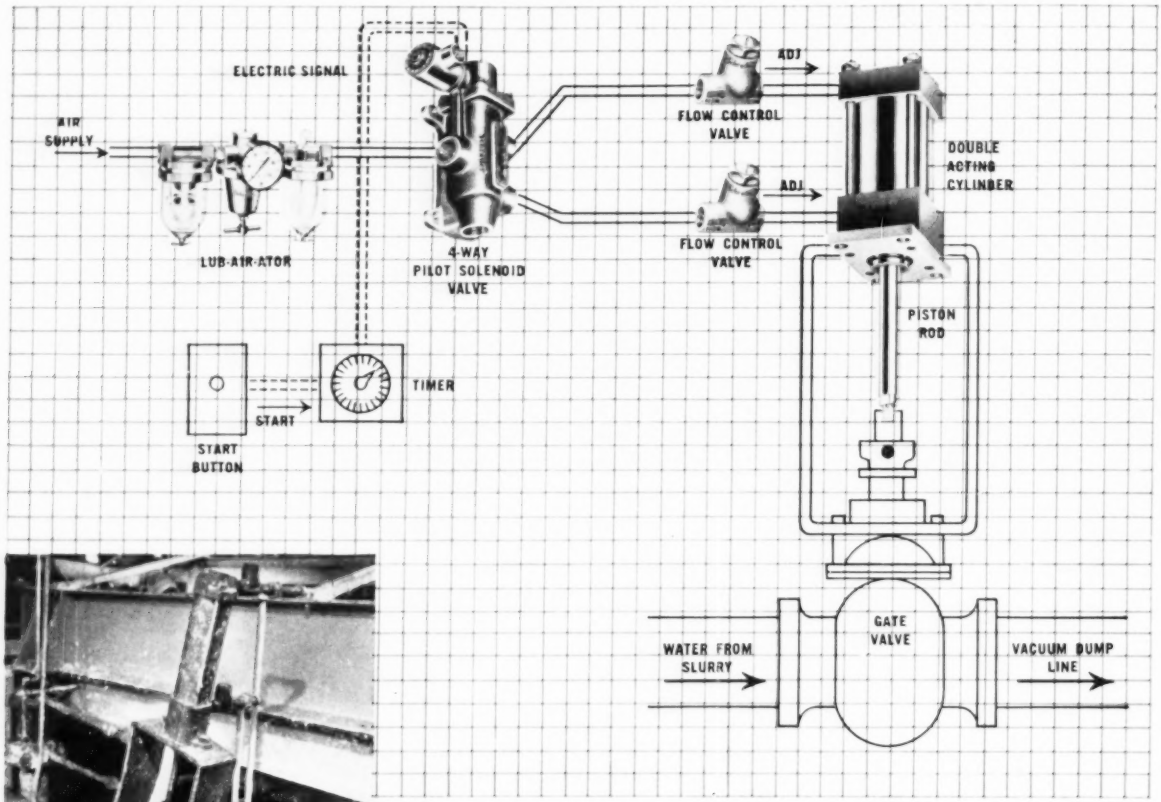
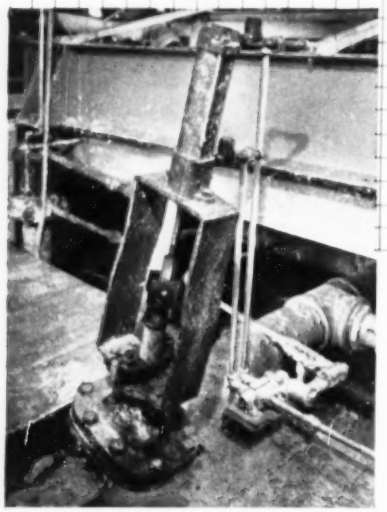
PROCESSOR SPLITS PRODUCTION BOTTLENECK WIDE OPEN WITH HOOKUP OF STANDARD SCHRADER AIR PRODUCTS





Here's how one company automates with air. The hookup of Schrader Air Products in the large diagram actuates gate valves used in processing a slurry of raw asbestos fiber and cellulose at The Republic Seitz Filter Corporation, Newark, N. J. This used to be a slow, arduous manual job. Now air does it quickly, effortlessly, under "conditions particularly difficult for most kinds of automatic equipment . . . without a minute's downtime and without any maintenance whatever," says the company's Technical Director. Schrader-trained air specialists helped plan this practical set-up, as they have helped plan countless others.

Boost productivity of even complex operations quickly and economically, like this company . . . with *air!* Plan it yourself, or let our experts help. A system of Schrader Air Products can simplify almost any bottleneck job . . . whether it's processing, assembling, testing or packaging . . . pushing, pulling, holding, positioning or moving work repetitively.

With Schrader Products, you can run practically any production line faster, safer, more economically—and with tireless accuracy! Maintenance is surprisingly low.

These are benefits every shop needs. Take advantage of them all when you automate with Schrader . . . the finest, the most complete line of Air Cylinders, Valves and Accessories . . . plus countless ideas for cutting your operating costs.

Select air controls from the full Schrader line. Your Schrader distributor can help you pinpoint what you need. For more data, write:

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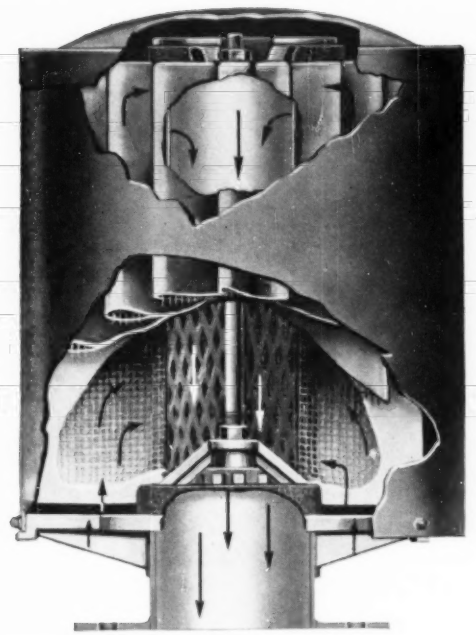

Staynew Intake Filter—Model D

STAYNEW
DIESEL INTAKE FILTER

The efficiency of Staynew Intake Filters actually increases with use. So why buy filters that require rigid maintenance schedules?

With Staynew Filters you get *positive* protection for vital diesel engine parts without maintenance problems . . . frequently no attention is needed for 2 years or more. When cleaning is indicated it can be done on the job with a brush or vacuum cleaning tool.

Other Important Advantages

- Silencer Filters available where noise is a problem
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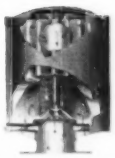
- Efficiency over wide range of loads
- No oil carry-over

Write for Bulletin 100 which contains complete engineering data and illustrated material on Staynew Intake Filters. Dollinger Corporation, Dept. 7, Centre Park, Rochester 3, N.Y.



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Whether it's low-pressure air for ventilating or high-pressure air for tool operation, you can depend on NAYLOR Spiralweld pipe to move it to the job.

Lines of NAYLOR pipe are light in weight—easy to handle and install. The spiral-lockseam structure provides the extra strength and safety for handling both push-pull ventilation and "high" air service.

In addition to pipe for air, it will also pay you to check into the advantages NAYLOR offers contractors for handling water.

For details, ask for Bulletin No. 59.

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Compressed Air Magazine

Founded 1896

VOLUME 64 NUMBER 12 **December 1959**

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243 Upper Thames St., London, E.C. 4.

PHOTO, JAMES M. STAPLES

ON THE COVER

THERE'S something about the Holiday Season that recalls a quieter time to almost all of us. The wintry solitude of these farm outbuildings seems guarded from summer's activity by the shadow-bars thrown up by the low-lying sun. Although the lane was marked by modern pneumatic tires, it is not hard to imagine a horse-drawn sleigh in the picture.

FEATURE ARTICLES

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Three air supply systems serve a testing complex at Northrop Corporation's Norair Division. A variety of complicated problems pertaining to design of inlet ducts and related flow ways has been solved.

18 **Karts and Christmas—** *Alec Lewis-Morgan*
St. Nick may well arrive in one of these vehicles. Here is a quick glance at a new sport and a new "industry."

20 **Sewage Ejector Stations for Suburbia—** *S. M. Parkhill*
Pneumatically operated packaged systems, buried beneath the ground, eliminate the need for building new sewage treatment plants in more remote industrial and residential areas.

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The twentieth annual awards will be presented in January.

24 **Ferguson on Air**
Nineteenth century scientists read with enthusiasm this lecture on pneumatics. Some of the statements come quite close to the facts as we know them. This begins a new series of brief articles about Compressed Air Oddities.

26 **Handyman for Film Processor**
A centrally located compressor maintains the quality of the work being turned out at a film processing house, while saving time and money and improving worker morale.

30 **Hydro-Air: Union of Ship and Plane**
The air-cushion effect is being applied to an over-the-water vehicle.

32 **High-Pressure Vessels Are Required**
For this era of rockets, new high-pressure containers must be built with more exacting methods of fabrication.

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R. W. Sapora, *Manager* J. J. Katarba, *Business Manager* L. H. Geyer, *Representative*,
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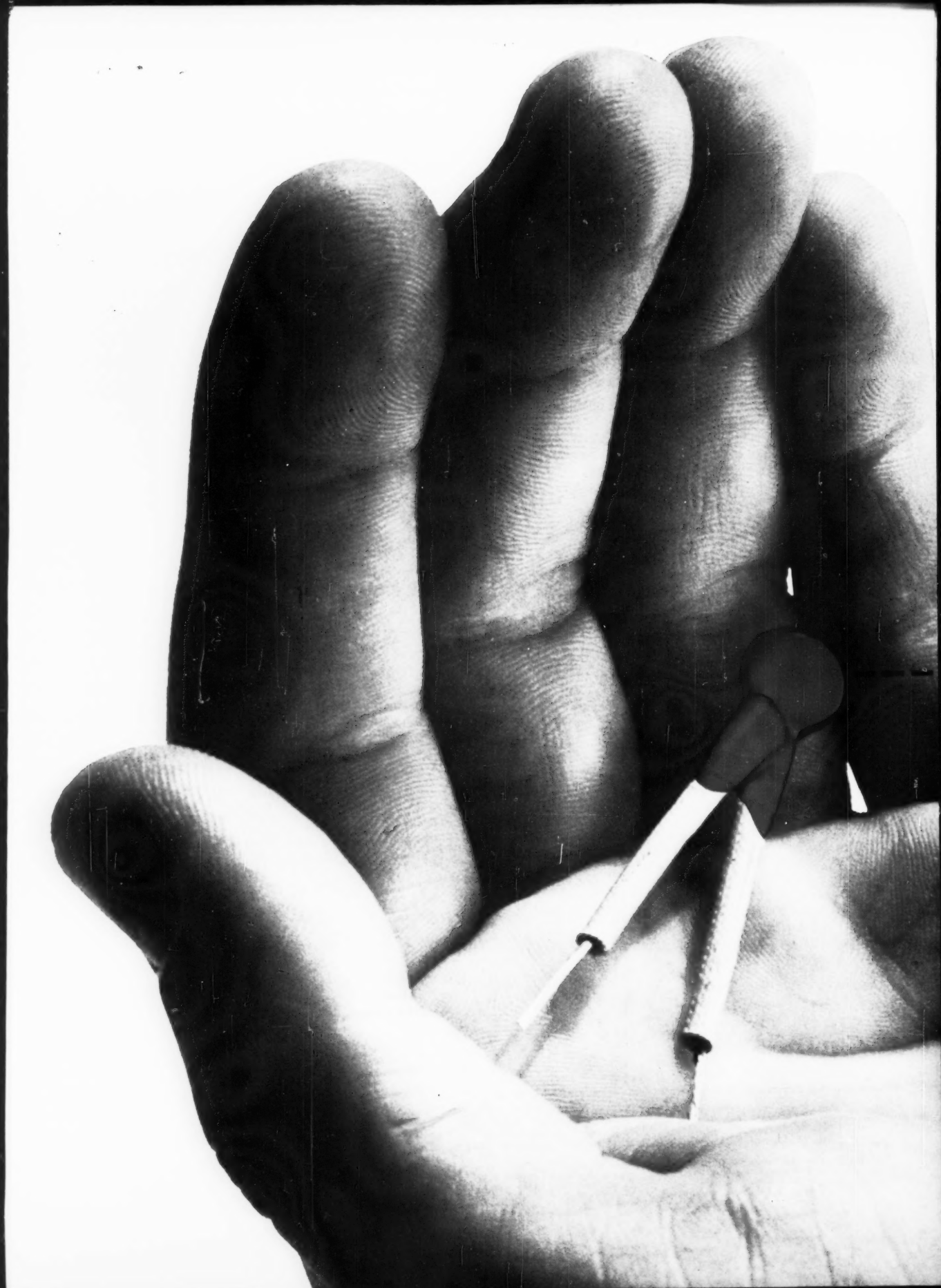

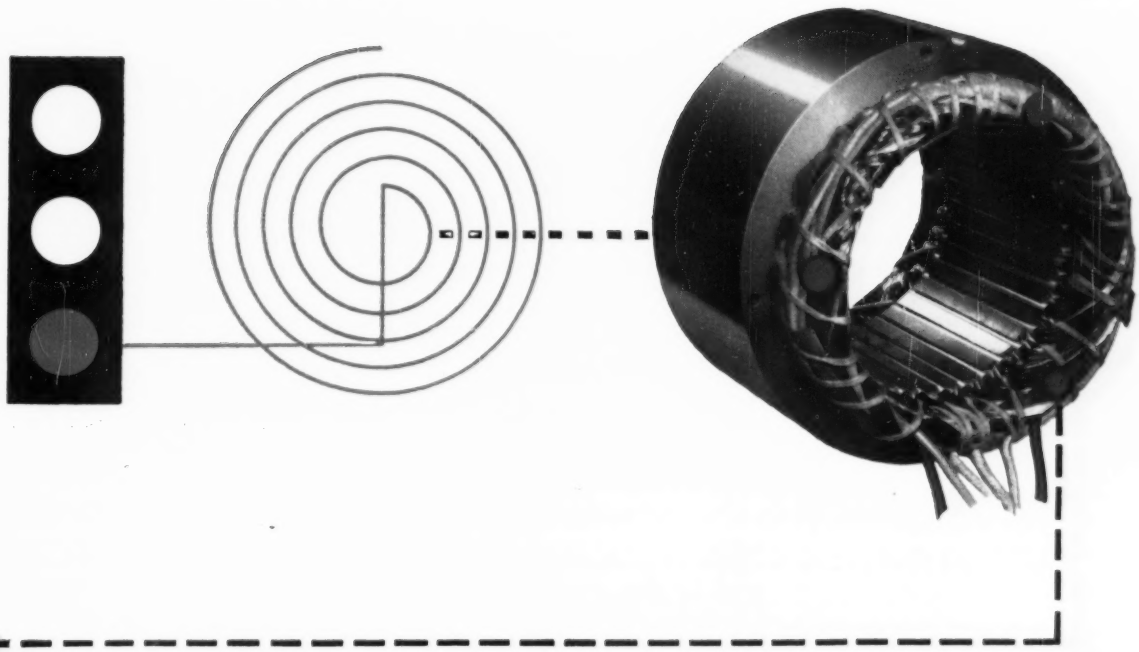

New Westinghouse GUARDISTOR motor stops motor failure caused by excess heat

At last, positive protection against motor overheating with this unique Westinghouse motor development. Smaller than an aspirin, the heart of the Guardistor* motor is a PTC† Thermistor embedded in the motor windings to sense temperature rise immediately.

With normal motor temperatures, the thermistor has low resistance which remains nearly constant up to a predetermined critical temperature. At this temperature, a 100 to 1 or more increase in resistance occurs for a small increase in temperature. The resistance stops current flow activating a control designed to "WARN" or "STOP" a motor failure.

The Guardistor motor and associated control integrates all heat-causing factors of load, ambient, and power supply right in the motor windings to give you complete protection against motor burn-out.

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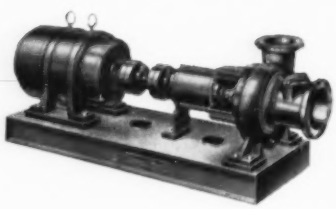
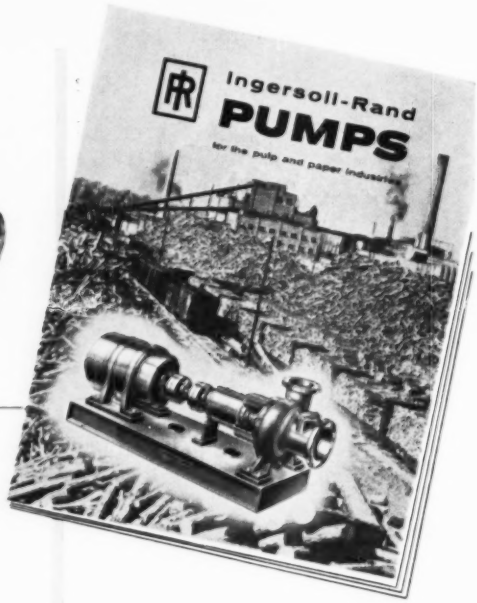
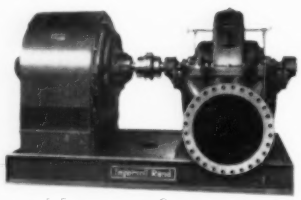
for the pulp and paper industry

STOCK PUMPS feature the patented diverging-type impeller in classes EL, EM and EH. This unique design will handle paper stock heavily entrained with air—where other ordinary stock pumps will fail. In addition, the special impeller has handled various types of stocks from 7% to 8% consistency without the aid of a mechanical feed! Over 10% stock has been pumped with a screw-feed arrangement on the suction. For lower stock consistencies and where there is no air problem, classes CL, CM and CH pumps having a conventional impeller can be furnished. For all classes—heads: To 225 ft; capacities to 7000 gpm; sizes 4, 6, 8, 10, 12 inches.



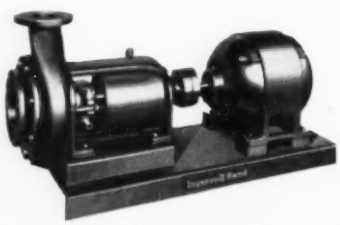


FAN PUMPS of single-stage, double-suction design are ideal for handling comparatively large volumes of liquids at low and medium heads. These pumps may be driven by any type of prime mover, and embody thoroughly modern design features that increase efficiency, insure reliability and lower maintenance costs. Capacities to 60,000 gpm.

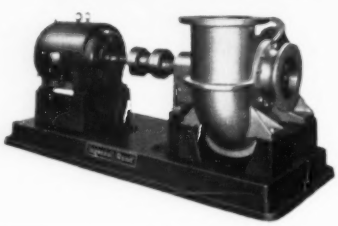


BULLETIN 7296 gives you further specifications and descriptions of all Ingersoll-Rand pumps for the pulp and paper industries. Its 24 pages are filled with cross-sections, data and installation photographs of I-R pumps at work in pulp and paper mills. For your copy of Bulletin 7296, contact your nearest I-R representative or write Ingersoll-Rand, 11 Broadway, N.Y. 4, N.Y.

CHEMICAL PUMPS are offered in a complete line for handling hot and cold acids and alkalis. They are single-stage units of end-suction design that are ruggedly constructed to last longer on the job. For handling highly corrosive liquids, these pumps are built of IRCAMET, a high nickel-chromium-molybdenum alloy steel that is corrosion resistant. Heads to 200 ft; capacities to 4000 gpm.



MIXED AND AXIAL FLOW PUMPS have a simplified construction that means fewer parts and less maintenance. Mixed-flow BPM propeller type is specifically designed to deliver large capacities at moderately low heads. Class APL axial-flow pumps are specially designed for handling large volumes at low heads. For both classes—heads to 40 ft; capacities to 20,000 gpm.



VERTICAL PUMPS are designed to handle liquids at heads ranging from a few feet to many hundreds of feet. Heavy-duty construction and high efficiencies are featured. Pump lengths and discharge locations can be furnished to suit the application.

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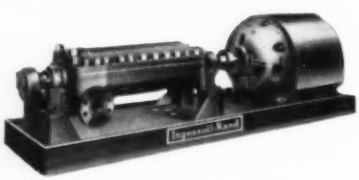

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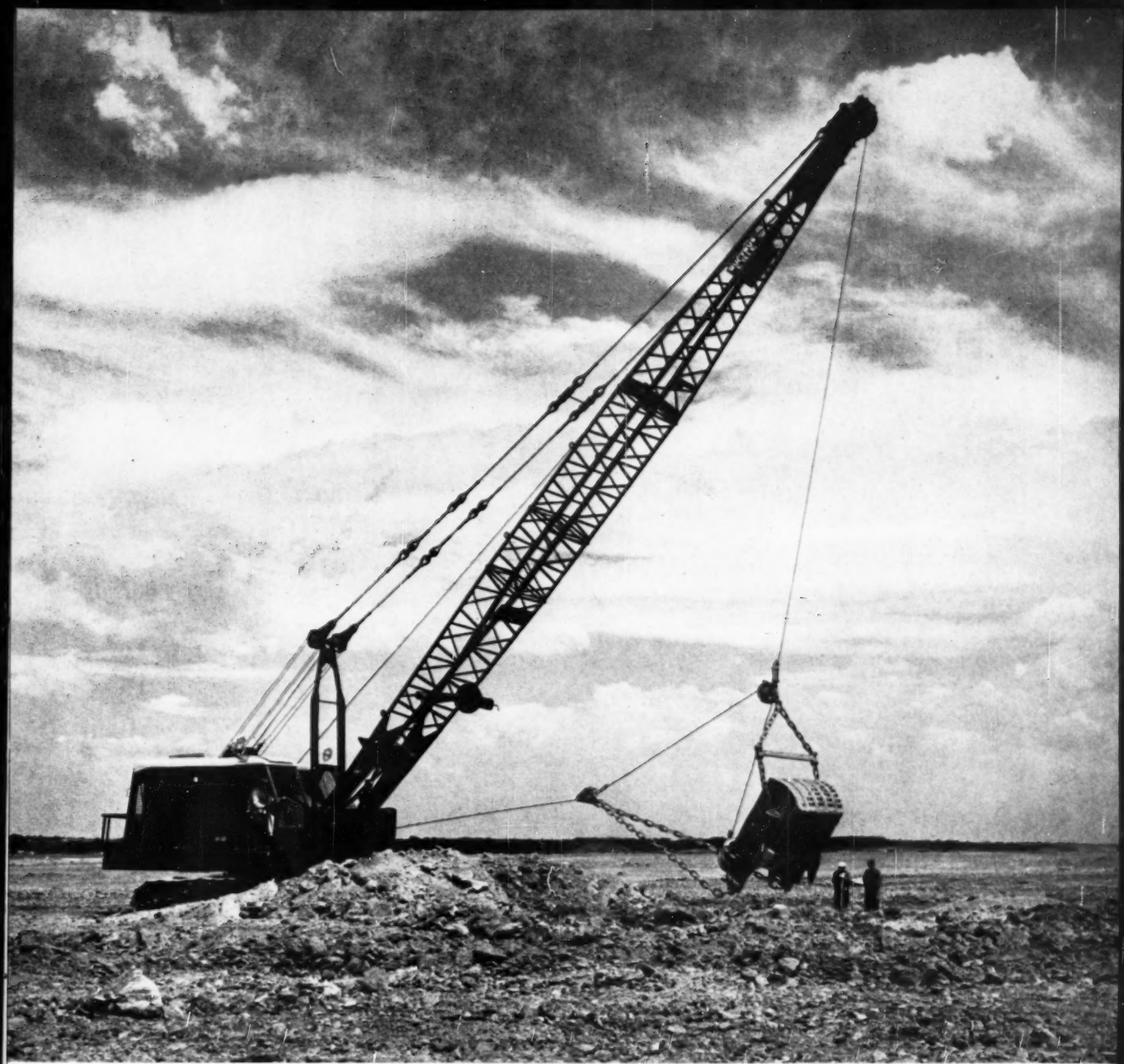

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Bethlehem wire rope gets a real workout on much of the busy earth-moving equipment at Dulles. Here it is turning in the same reliable performance for which it is so well known wherever construction is in progress.

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Mill depots and distributors from coast to coast stock Bethlehem wire rope

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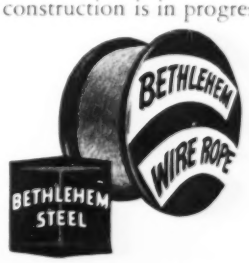

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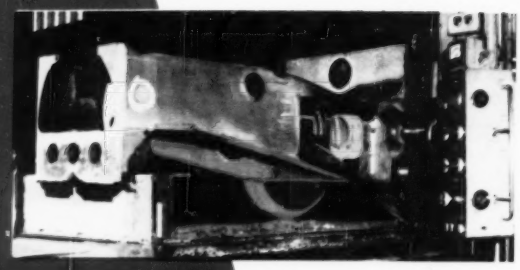
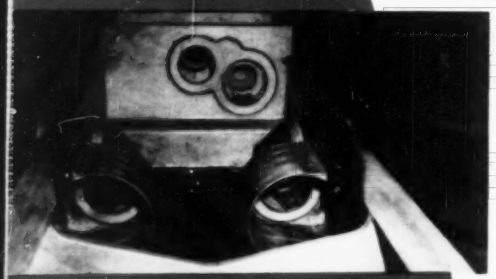
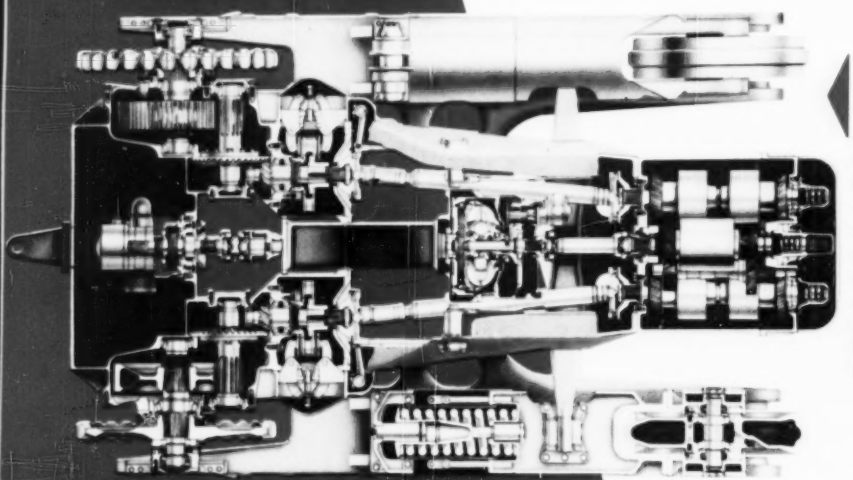


Main frame, Final Drives and Center Housing, produced, through Eimco's unique and exclusive Unitized "Stress Flow" Construction, in a single, strong steel casting, resists torque and stresses beyond any you can place upon it.



Thoroughly tested and proven, engineers checked and analyzed a precise and complete wooden mock-up before the first steel casting was made . . . built in extra strength and rigidity where needed. No welds or bolts in this assembly! Just like the heaviest locomotives, it is built for many extra years of trouble-free operation, with no excess weight . . . extra strength where it is needed.



Take a good look at this horizontal cut-away view of the modern 103 crawler-tractor. Here is perfection in engineering . . . brilliantly simple . . . ruggedly strong . . . incorporating more exclusive and important "firsts" than any other crawler-tractor on the market today. Built by craftsmen who care . . . the famous craftsmen and specialists of The Eimco Corporation, known throughout the free world for highest quality and dependability.

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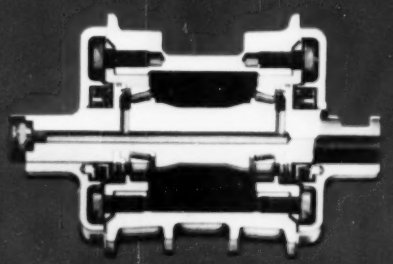
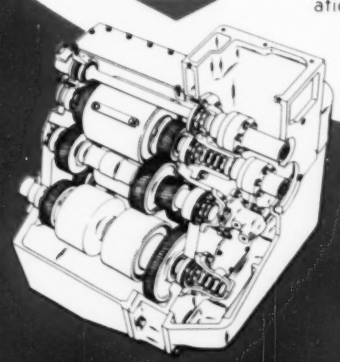


Track rollers are one-piece heat treated alloy steel castings, with extra oversize tapered roller bearings, each fitted in its own cage, with precision-lapped seals.



Backed by the record-breaking performance and on-the-job proven engineering of the famous Eimco 105 line, which has recorded less than half the maintenance costs of other makes . . .

The great 100 HP Eimco 103 Series challenges comparison!

The first modern tractor specifically engineered and built to fill your power, size and work needs in the 100 HP class . . . the perfect medium size tractor, from Eimco . . . pioneers in **modern** tractor design and engineering.

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"Quadra-Torque" . . . new, modern power team, offering four forward and four reverse speeds at the flip of a lever through heavy-duty single stage torque converter. Lets you shift from any gear, forward or reverse, to any other, at any tractor or engine speed.

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Full 17-inch Ground Clearance . . . can climb 90% grades, forward or reverse.

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Featuring 205 working H P, the 106 is available as tractor, dozers, the world's most powerful Front End Loader (Model 126) and Special Steel Mill Front End Loader (Model 136) as well as the famous Eimco 146 Log Loader. Features Eimco maneuverability, economy and quality.

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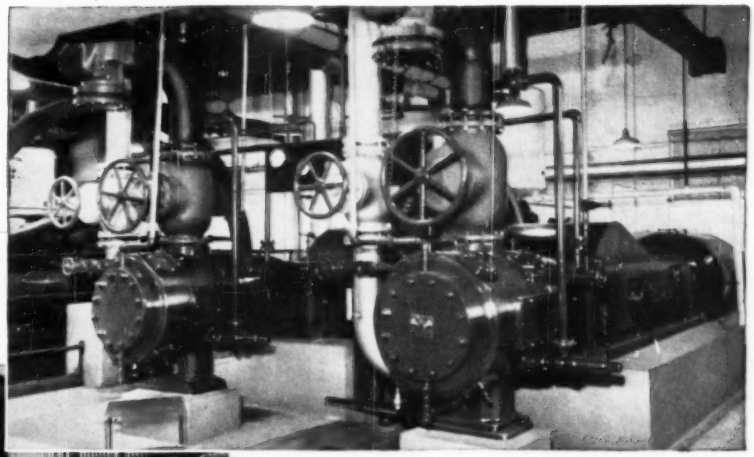
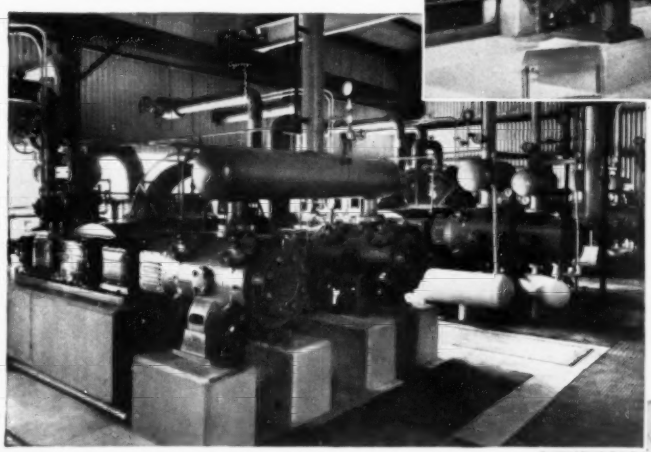


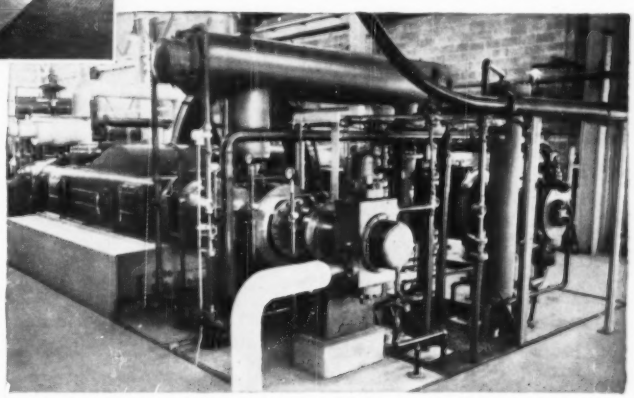


REFRIGERATION

One of two Ingersoll-Rand XPV compressors handling ammonia for refrigeration in a large Midwestern plant. Two of these modern units are installed in the space formerly occupied by a single old-type compressor, and provide greater capacity with safer, more efficient operation and much less down time. Another XPV in the plant compresses air.

CATALYTIC CRACKING

Three XPV compressors in a large refinery: in foreground is a single-stage unit handling flue gas; two 3-stage units in background compress inert gas. There are hundreds of XPV's on all refinery services, including hydrogen recyclers with "NL" non-lubricated compressor cylinders.



UREA MANUFACTURE

This 860-hp XPV compresses carbon dioxide in four stages for the manufacture of urea. There are four XPV compressors in this chemical plant, including ammonia synthesis gas circulators.

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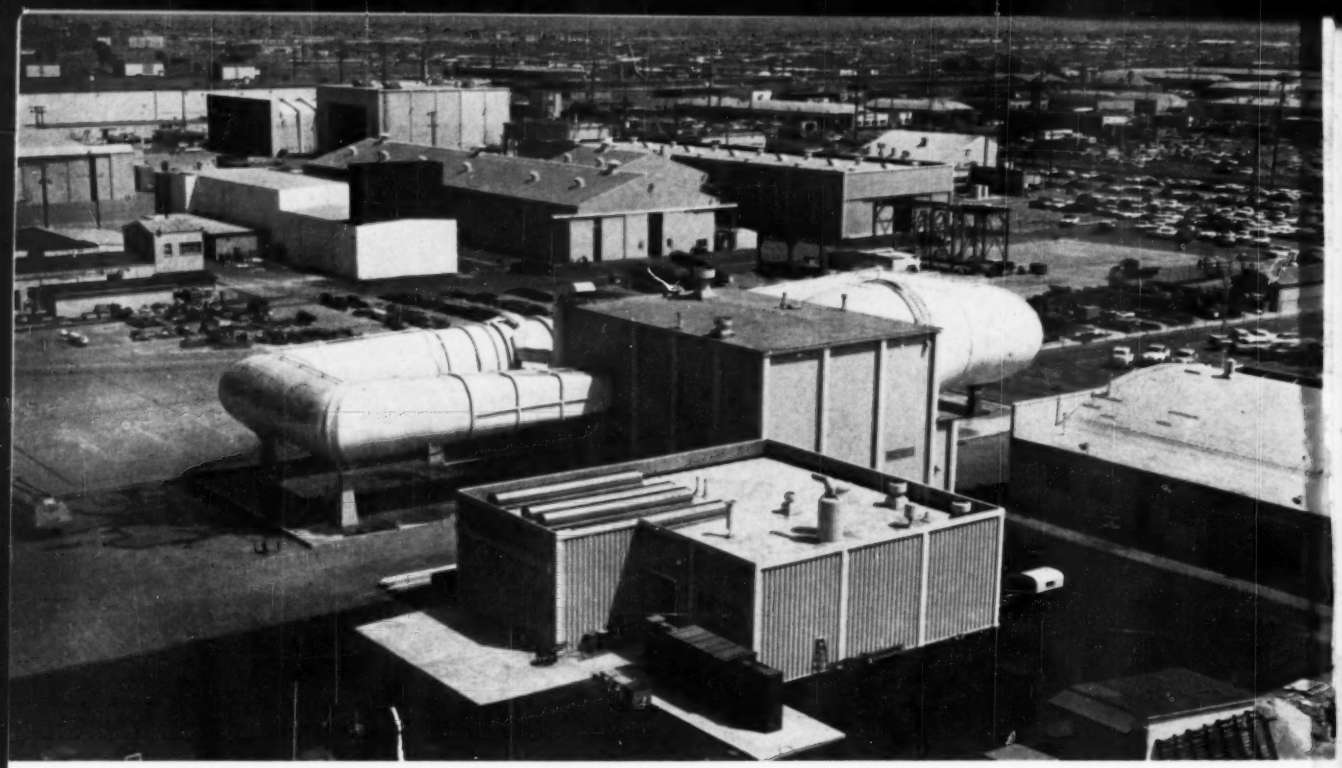


Flight Simulation

Without Forward Velocity

HENRY M. KARASZEWSKI

COMPRESSED AIR and vacuum are playing important roles in the Aero Sciences Laboratory at Norair Division, Northrop Corporation, Hawthorne, Calif. There, the testing of high-speed weapons systems, utilizing air-breathing propulsion equipment is being carried out. The facility is called upon to determine the performance of over-all air induction systems. Speeds simulated are in the ground warm-up, take-off and landing regimes. The internal performance of related ducting is also examined at conditions identical to those encountered at full military power.

The inlet and duct test facility was authorized in 1957. In post-war years, engineers at Northrop had foreseen the urgent need for a means by which the airflow distribution through ducts could be investigated and the performance of air induction systems evaluated. They believed that the determination of internal duct-loss characteristics and knowledge of the net effectiveness of secondary airflow devices would greatly benefit aircraft and missile development.

In addition, they realized that as cooling requirements for engine installations grew more severe, some means should be at hand for investigating boundary-layer suction flows and normal by-pass flows associated with cooling. The facility, it was specified, should be arranged so that high-speed flight conditions could be studied while the weapon had no actual forward velocity. With such an arrangement, configurations and inlet lip thicknesses could be evaluated and performances determined prior to the manufacture of actual flying craft. It was also realized that such an installation would minimize the compromise between actual and simulated conditions, thus making for safer and more stable operation.

The physical requirements called for accommodating a model, 40 feet long, 4 feet high and 4 feet wide, in such a way that the effects of the walled enclosures would not affect the test results. Two such test cells were designed. They enable operations to continue on one program while another model is being installed or dismantled, or a configuration change is being prepared. The walls, ceilings and floors in the model enclosures are perforated and, by means of large roof ventilators, are vented to atmosphere to provide uniform 3-dimensional airflow. Each test cell is 40 feet long, 13 feet wide and 13 feet high.

Of primary importance to the design of the facility was the selection of the air systems to generate the airflows. In addition to meeting the basic pressure and vacuum needs, the compressors had to have extremely rigid control and cleanliness characteristics. (A typical model of a weapons system has hundreds of hypodermic static- and total-head rakes and orifices that can be easily plugged with dirt or oil.)

The control system for the attainment of test settings was to be simple and fast acting; further, there was to be no flow variation once a setting was achieved—no surges or dips in pressure could be tolerated. The compressors would have to withstand unexpected equipment surges and stalls. Exit pressures would have to be steady and controllable to plus or minus 0.1 inch of water. Since the operator would

NORAIR TEST ESTABLISHMENT

In the foreground is the inlet and duct test facility with the adjacent 7×10-foot wind tunnel at the Norair Division of Northrop Corporation, Hawthorne, Calif. The recent addition of this complex facility is typical of Northrop Corporation's highly geared engineering program. Other buildings in the picture house an engine test cell, environmental test laboratory, vibration facility, fatique test laboratory and missile count down laboratories.

not have the opportunity to monitor against equipment damage due to normal flow conditions, and the compressors would be required to start and stop without any warm up or warning period, an inherently safe operating system was mandatory. Automatic controls were to be provided so as to completely protect all units.

Ingersoll-Rand compressors met all of the requirements and were chosen for the compressor plant. The primary system is centered on a 175×42 Axi-compressor. It is a rotary machine which operates on a positive displacement principle. It is the largest and most powerful of the Norair compressors, and is used either as a compressor or an exhauster. Water injection was added to this unit, making it capable of choking inlets up to 19.5 square inches of throat area when used as an exhauster. The water injection system is completely automatic and works on a pressure principle rather than temperature, resulting in a more efficient operation.

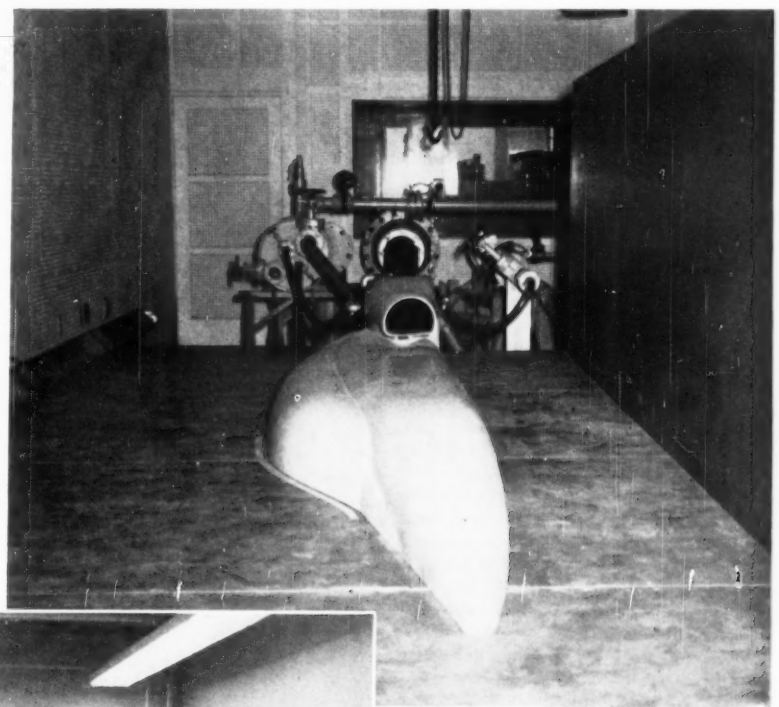
The airflow ducting, consisting of 16-inch pipes, terminates in each of the two test cells, as well as a nearby 7×10-foot wind tunnel. Suitable flanges are provided for the purpose of model installation. DeZurik throttle-and-bleed valves, operated by Moore positioners and regulators, control the desired airflow conditions, whereas orifice meters measure the airflow quantities. This compressor, as are all of the other units, is shock-mounted for protection against pipe vibrations due to model or component failures.

The secondary system is composed of a 900×20 Axi-compressor. This unit is similar to the primary one, but of smaller capacity, and is used only as an exhauster. The 10-inch piping in this system parallels the primary ducting and is controlled in the same manner.

For the auxiliary system, three 125-hp Type 40 Ingersoll-Rand air-cooled reciprocating compressors were chosen. This system supplies 115-psia air pressure to each point served by the primary

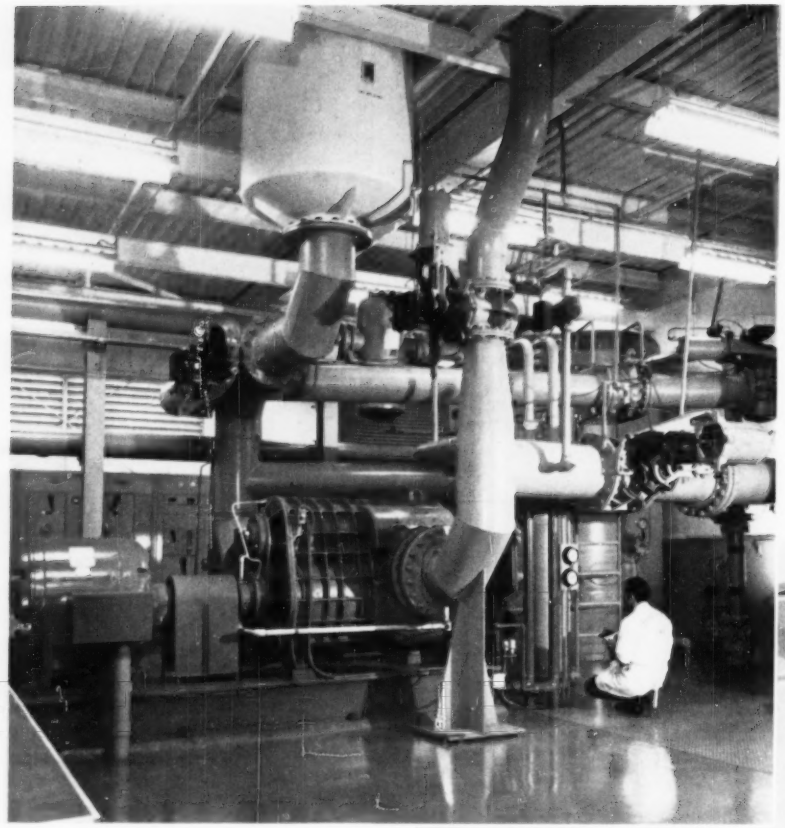
TEST IN PROGRESS

A typical model test configuration is shown here. The model is mounted on a backboard to prevent body cross flow. Another ground board simulates the position of the aircraft's main duct inlet relative to the ground. For this test all three flow systems for air were used. The 16-inch line terminates (left) in a plenum chamber, which was used to control line surges and could be set by individual valves for the various flow conditions required. The 10-inch line ends at the center; and the 4-inch, high-pressure line, at the right. Air flows are regulated from a console in the control room shown below.



CONTROL INSTRUMENTS

The multimanometers shown (center) in the control room use alcohol, water, tetrabromoethane or mercury, depending upon the type of test. Pictured also is the electronic pressure measurement read-out system (left). Pertinent flow data are displayed, and permanently recorded on punched cards and printed forms (foreground). From the control console (right) the operator has an unobstructed view of both test cells.



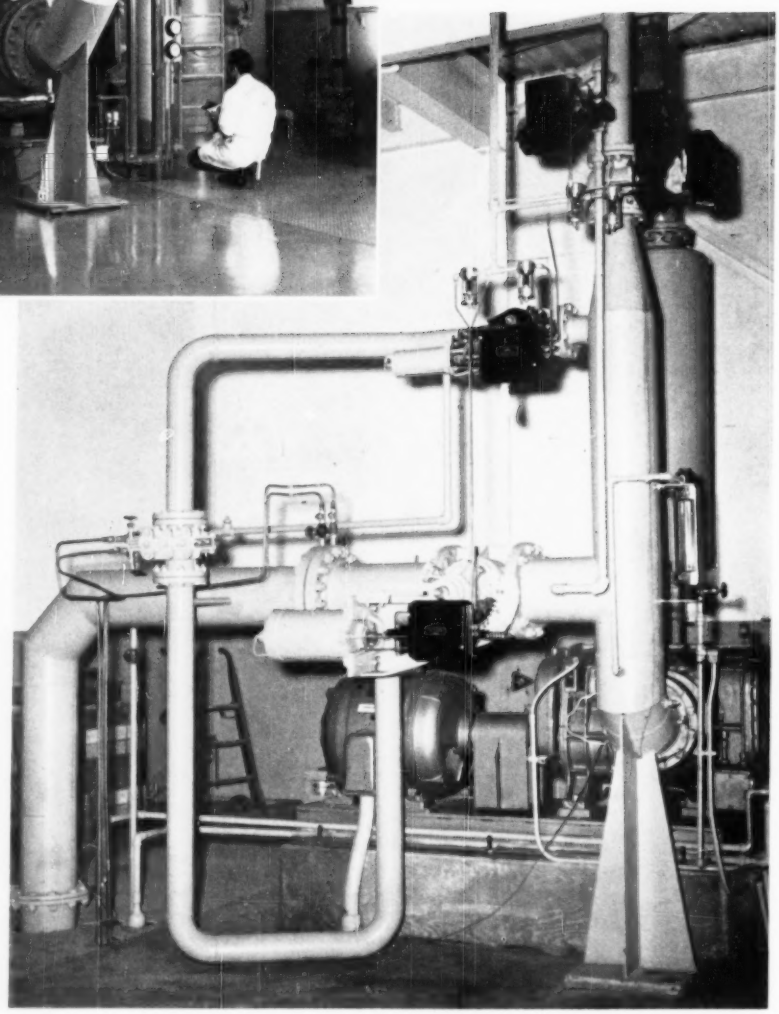
PRIMARY COMPRESSOR

This view shows the Ingersoll-Rand 175×42 Axi-compressor and the associated piping which make up the primary system. The three throttle-and-bleed valves offer a myriad of flow combinations. This unit may be operated either as a compressor or an exhauster. It is driven by a 350-hp motor. As a protective feature, all piping is self-supported and shock-mounted to the compressor.

and secondary systems. A series of aftercoolers, pulse traps (pulsation dampeners), moisture separators and filters are incorporated in the piping complex prior to the point at which the 4-inch line enters a 460-cubic-foot capacity pressure vessel. This storage tank permits the normal weight-flow limits of the system to be extended by intermittent testing operations when desired.

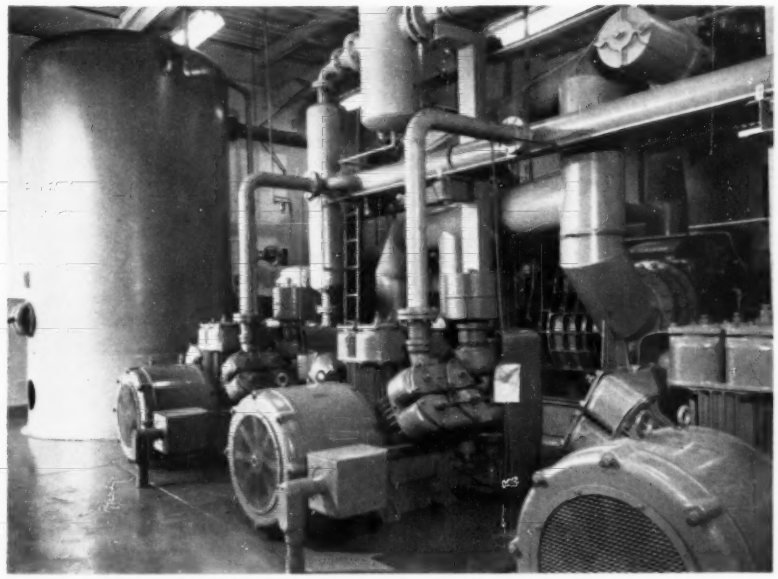
The three systems may be operated either individually or together. For example, an inlet-lip-thickness test may require the use of one system, whereas an engine inlet duct may be tested complete with the various accessory cooling and bleed flows anticipated in flight. These conditions would require use of all compressors for the complex flow combinations.

Operating controls are located on a console in a soundproof room, from which the operator has an unobstructed view of the two test cells. The twelve throttle-and-bleed valve controls are located below the pressure monitoring and recording gauges. All of the compressor and line air tempertures are monitored, displayed for the operator, then automatically and permanently recorded; safety devices protect the test article and compressors. The pressure measurements and metered airflows are recorded on manometers and



SECONDARY UNIT

The secondary compressor is an Ingersoll-Rand 900×20 Axi-compressor driven by a 100-hp motor. Two throttle-and-bleed valves are employed in this exhauster system. Water injection is supplied automatically for extreme conditions.



AUXILIARY AIRFLOW SYSTEM

Three 125-hp Type 40 Ingersoll-Rand air-cooled compressors supply 115-psia air pressure. Also pictured are the aftercooler, pulse trap, moisture separator, filter, and the 460-cubic-foot storage tank. A throttle-and-bleed valve controls the required airflows.

pressure transducers. Guttering is provided between the test cells and control and compressor rooms by removable floor plates that provide accessibility. Permanent pressure and instrumentation leads are enclosed within this gutter network with quick-disconnect panels at the termination points.

A unique guillotine system is employed on all of the manometers as a safety feature against manometer "blow-over," thus removing the possibility of damage to models and instruments. It also enables the operator to interlock the manometers, permitting the engineer to study a test pattern or profile while another configuration setting is being achieved.

The manometer and transducer data are permanently gathered by photomanometry and electronic systems which punch results on cards and enter them on printed forms. The use of transducer valve packages within the models reduces errors caused by slow-response manometer methods. Further, final data are immediately obtained. Tubing lengths from the test article to the recording instruments have been reduced considerably with use of the valve packages, a factor accounting for faster and more accurate installations. An on-line plotter, within the system complex, plots data simultaneously with the testing runs.

The facility was put into operation in 1958. To date, several successful testing programs have been completed, resulting in the solution of many problems unique to high-speed, high-altitude flight. The very successful test flights of the Northrop T-38 Talon supersonic trainer and the N-156F Freedom Fighter can be attributed greatly to the extensive testing and development work in both Norair's wind tunnel and the inlet and duct test facility. Checks of normal bypass flow during high-speed flight conditions, of inlet ramp bleed systems and boundary layer effects represent only a small portion of the development programs being carried out.

A typical system tested in the facility could be described like this. The bypass system provides cooling air for the engine bay in an aircraft. At low speeds the air enters the engine inlet duct from the main bleed system (a reverse flow condition) because of the lower static pressure in the main engine duct resulting from engine operation. As the airplane speed is increased, the static pressure in the engine inlet duct exceeds the static pressure in the engine bay; then the flow is from the main duct into the bleed system (a normal flow condition). In one test program, a ground board was employed to simulate the position of the inlets relative to the ground.

The facility is also used in conjunction with the wind tunnel on several model test programs. Providing boundary layer suction and controlled internal flows to models undergoing test in the wind tunnel are typical applications. All weight flow removed by the primary exhauster is returned to the wind tunnel through a 16-inch line.

In addition to the development work conducted, the I-R compressors are being utilized as the main power source for a pilot-research supersonic wind tunnel. Speeds of Mach 3.85 have been achieved in this continuous tunnel, and tests on model programs as well as wind tunnel research work have been conducted. The primary system is utilized as the vacuum source, the auxiliary system supplies the pressure, while the aftercoolers provide the dehumidification.

A typical program was a heat transfer study on a rocket nose cone. In this case the model was cooled to a temperature of minus 340° F, and the tunnel was run up to a velocity simulating rocket speeds. Thermocouples inside the model and on the outer surface measured the increasing heat generated by friction with the skin.

Many areas of research and development may be exploited within this complex, which, in the past, have been investigated with a certain degree of compromise. Internal flow problems that are not amenable to theoretical treatment thus can be examined experimentally prior to fixing final design specifications.

The Norair inlet and duct test facility can be classed as a unique research laboratory offering empirical confirmation of many problem solutions relative to internal flows in air breathing propulsion systems.

NOSE-CONE TEST

The primary compressor provides the suction while the auxiliary supplies the pressure for the Mach-3.85 wind tunnel. Here, heat transfer studies are being conducted on a model of a rocket nose cone. This supersonic tunnel is used mainly as a pilot-research tunnel, where nozzle and diffuser configurations may be studied.

Karts...

and Christmas

ALEC LEWIS-MORGAN

WITH the ether currently cluttered with all manner of unfriendly appearing scientific contraptions, there is a chance this year that Santa will travel in another phenomenon of the space age. This is the "kart."

A kart is a tiny racing car that is usually powered with a 2½-hp, 2-cycle gasoline engine. A kart is rudimentary but fun. Its short wheel base means the driver must coil up his legs to reach brake and throttle pedals, mounted just inside the front wheels. The bucket seat's back is a firewall that protects the driver from the propulsion plant to the rear. The engine usually drives the left rear wheel. The same tubing that forms the car's axles is part of the frame; another pair of tubes connects the two axles. The car's steering apparatus is a simple tie rod in front and may be actuated by a wheel or a pair of handle bars. Steering is quick by any standard—about one-quarter turn from lock to lock.

Actually the pilot in the ultrasonic X-15 and the man in the kart are not really too far removed. Modern man, and we suspect Santa too, has a yen for speed. It would take Santa much longer of course to travel from the North Pole via kart than by 3000-mph X-15, but then the appearance of speed is relative. Zipping along at 50-mph in a kart while sitting scant inches above the track probably seems just as fast as whistling through the outer void at Mach 3. And besides, every man is not a test pilot and he wants fun from his speed instead of technical data.

Karting started only about 2 years ago in California. The first manufacturer of the cars was the Go Kart Manufacturing Company of Azusa. The two founders of the company began assembling the cars in a section of their muffler shop in Morovia, but quickly graduated to a modern, well-equipped plant with complete engineering and production facilities. An idea of the installation can be learned from its test track. This is a road course built especially for the karts, having eleven corners. It is 0.4 mile long and cost $15,000. The concern's trade mark, Go Kart, is nearly generic for the cars and the first model, the 400 Kart, seems to be the prototype for the entire industry. It has a 44-inch wheelbase and is 56 inches long. Maximum height at the center of the seat is 21 inches. The 400 would force a speedometer, if it had one, up to 35 mph. This kart costs $129.50 or $148, depending on whether one purchases the kit completely unassembled or partially assembled. Painting costs a little extra too. Some makes of karts can be purchased completely put together and these usually cost close to $200. In general, the range of the karts runs from $150 to $250. Costlier ones are available.

Other companies were not slow to follow the pioneer. The Goodyear Tire & Rubber Company recently estimated that there are now about 300 companies manufacturing karts in the U. S. This figure is probably quite generous. All sizes of builders, from neighborhood welding shops to large engineering concerns, are producing the cars; the smaller companies can stop manufacturing just as quickly as they started. Goodyear also says there are about 40 distributors selling to some 1400 dealers in the U. S.—Santa should have little trouble filling his orders. The Goodyear people have an interest in the business because they make pneumatic tires. They have started a program to develop special tires for kart racing and have stepped up production of their existing lines. Other companies, General, Goodrich and Firestone, also make tires for karting.

Competition between drivers of the estimated 10,000 small but speedy conveyances in the U. S. is far from being restricted to refined tracks like those in California. The sport's spawning grounds seem to have been the parking lots of supermarkets. Other circuits are set up on airport aprons, school cinder tracks, municipal parking areas and the like—all that is needed is an open hard-surfaced area and per-

mission to race there. A popular U. S. sports car magazine tested one on the smooth asphalt of the sports car circuit at Lime Rock, Conn., using only part of the course. John Fitch, the track's director, and one of the United States' most seasoned sports car drivers, gleefully took the wheel, indicating that the cars present plenty of challenge to a serious driver as well as to the more fun-seeking amateur.

The Go Kart Club of America has drawn up three classes for the machines: A, B and C. Such classes, as with sports cars, are decided by the total displacement volume of the engine cylinders—in the case of the kart, *the* cylinder. Class A includes cars with displacements up to 5.8 cubic inches (95 cubic centimeters); Class B, 5.81 to 11.6 cubic inches (190 cubic centimeters); and Class C, 11.61 to 16.5 cubic inches (270.385 cubic centimeters) unsupercharged, or less than 5.8 cubic inches displacement, (the Class A size), supercharged.

Engine displacement is increased by not only buying a larger engine but by installing a second engine. Formula K, as the three classes are called collectively, also lists several other specifications designed to keep the karts the simple but safe machines they are. This does not prevent adding improvements and accessories however, and man's flair for gadgetry can be vented fully here. Accessories available are clutches (most karts are push starting), disk brakes, ram air boxes for carburetors, fuel injection, high compression pistons, tuned exhaust pipes, and vacuum cast aluminum wheels. Many engines are available within a wide range of costs, depending mainly on the type of bearings used. One Japanese-made plant turns at a screaming 10,000 rpm.

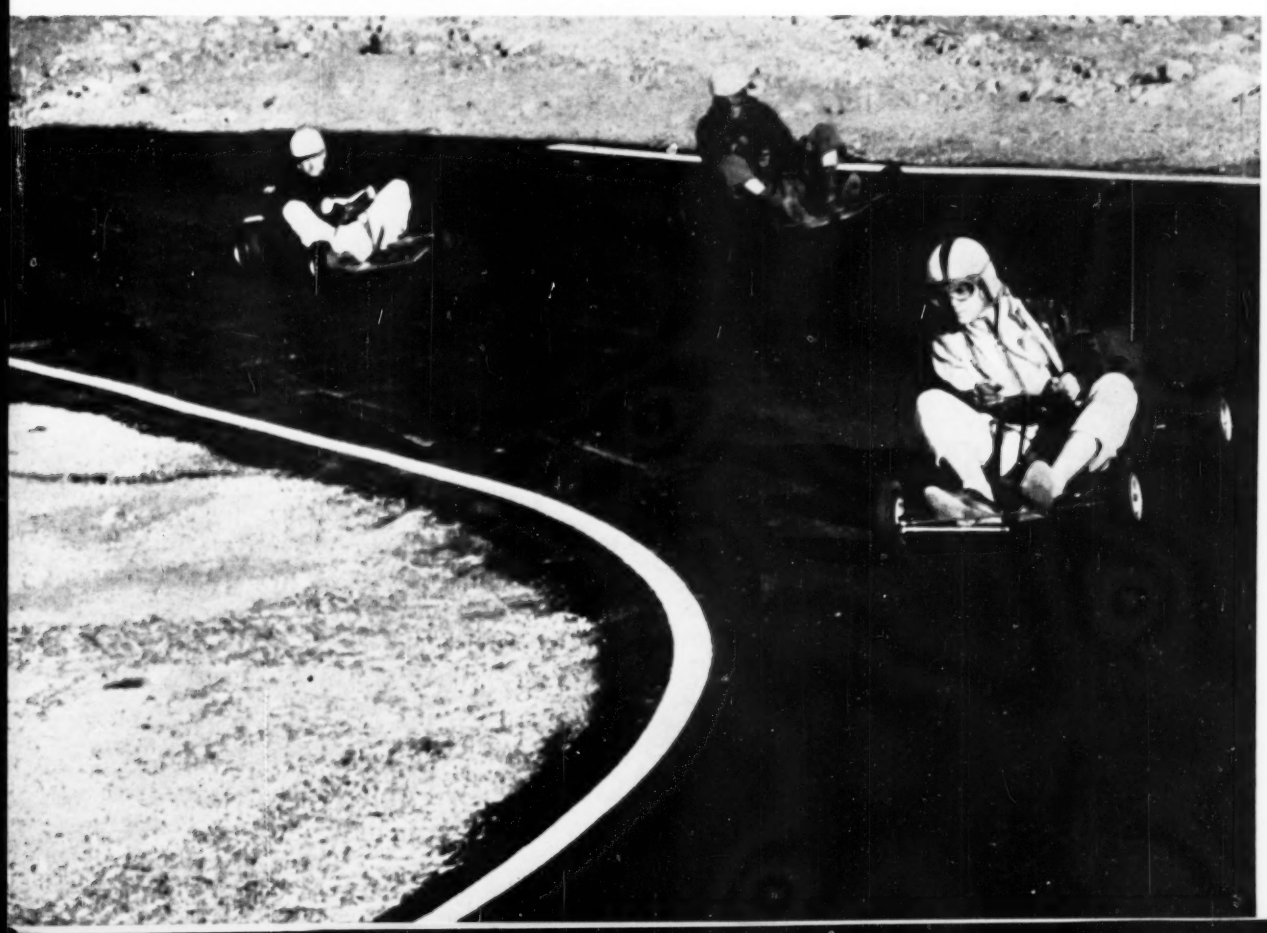
Karts' rapid spread in popularity throughout the U. S. is probably due to the large amount of fun gained for the money invested. Santa could certainly afford to leave more karts under Christmas trees than he could, say, Maseratis, Aston-Martins, Porsches or Corvettes. Yet the difference between the fun of racing sports cars and karts is not so widely separated as are the prices of the cars to the karts. There is evidence that the kart craze at least partially followed on the shirttail of the sports car's popularity. There is quite an overlapping of the two groups of enthusiasts though the "kartist's" sport is more than sovereign.

One impression that an observer of a kart contest may gain is that driving the lawnmower-motors-on-wheels is a youngster's activity. This is true to a degree, but probably most of the drivers are adults. Some perhaps acquired the sport much in the vein of the father who takes over the son's electric train. But racing is not necessarily relegated to the male side of the family; you can also see mother, crash helmet and goggles donned, cruising through corners at peak revolutions.

Competition among kartists has developed to such a degree that in July of this year national kart races were held in California for the three Formula K classes. (The average cost of the entrants' mounts was about $500.) A friend of ours who attended the races tells of seeing a jolly, white-bearded man out there wearing a red suit in the hot July sun. He sat astride a kart, his black boots working the pedals and his plump middle just clearing the steering wheel. Again and again he drifted his little car through the esses, while over his shoulder a long bag, only partially filled, swirled in the summer breeze. We saw no reason to doubt our friend's report.

CORNERING KARTS

Leaning hard to starboard, three kartists negotiate a corner of this California track. Though special courses have been built for the little cars, they are more often seen on parking lots and other such existing expanses of hard surfacing. The drivers wear crash helmets and leather jackets for protection—if the wrong "line" is taken through a corner at speed, that low center of gravity may disappear in a puff of infield dust.



Sewage Ejector Stations For Suburbia

S. M. Parkhill

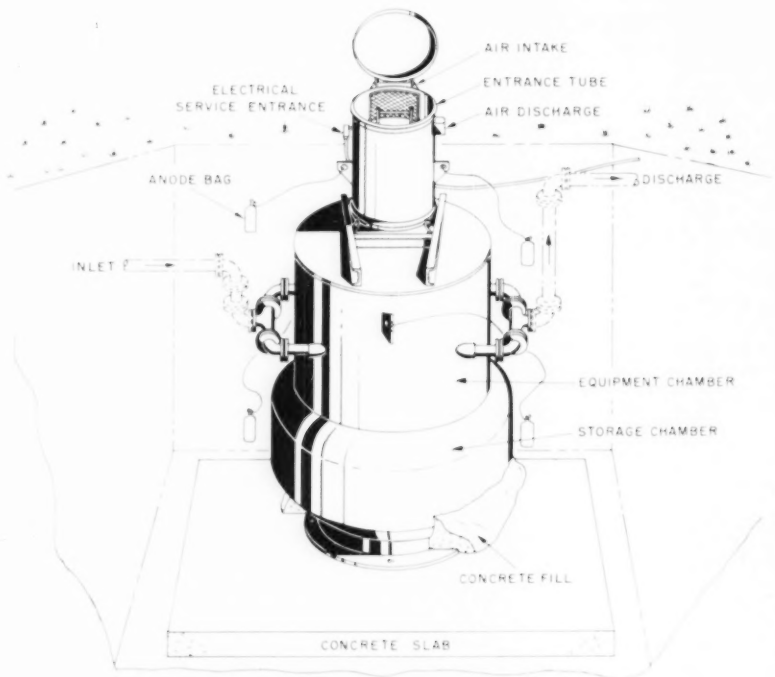
THE EXODUS to the suburbs in the last decades has a variety of interesting aspects, not the least of which is the problem of sewage disposal. In most instances, sewage treatment facilities have already been established in urban areas. To build new plants to service the relatively small suburban sections would be prohibitively expensive. If the sewage could flow by gravity to the existing treatment plants, the problem would be solved. Unfortunately, some areas are too low or too flat for this. The sewage must first be raised, or ejected, before gravity can take over the moving job.

Schmieg Industries, Inc., Detroit, Mich., fabricates packaged ejector units, called Centri-Lift Stations, to meet just such suburban requirements. These are automatic units that can be used equally effectively in semi-isolated industrial or recreational areas. They are almost completely buried beneath the ground; only their ventilation and entrance segments protrude. Consequently, each ejector must be a quality product to eliminate both continual inspection and down time for repairs and part replacement, and to operate efficiently for a number of years. Company officials indicate that the Centri-Lifts have a service life of about 25 years, and although no installation has passed a quarter century of service as yet, it is thought that a properly installed unit will actually have a longer service than that. Such a statement is based on the facts that each station is carefully fabricated and tested before it leaves the shops, and that it contains only quality components with the reputation of endurance.

Indicative of the craftsmanship are the seams and final coatings. All joints are welded on both the inside and outside to prevent ground water from seeping into the unit and harming the contained equipment. After each unit has been completed, it is sandblasted and hydrostatically tested to a pressure of 90 psig. It is then given a coat, inside and out, of Du Pont's submarine primer. The outside receives an additional layer of bitumastic protective coating, or epoxy enamel. (To further protect the ejectors from corrosion, four packaged magnesium annodes are supplied with each unit. These are buried in the ground at the time of installation.)

The emphasis placed on ejector production is relatively new for 25-year-old Schmieg Industries, although Centri-Lifts were first fabricated in 1956. When the company recently passed from the control of Frank and John Schmieg to that of a large holding company, product emphasis was placed in public works fabrication. The Centri-Lift ejectors are an important part of this program. Also fabricated at the plant are underground pumping stations, dust and fume control equipment, spray booths, mechanical washers, industrial ovens and similar sheet metal equipment and accessories.

Each Centri-Lift is fabricated on order, and at the present time, the shop has a potential output of four units per week. These vary in size from 6 to 10



ANATOMY OF AN EJECTOR

The installation drawing shows the entrance tube, the equipment chamber beneath it, and the storage chamber at the bottom. The particular unit illustrated is a duplex ejector station; a simplex station is similar, except that it has single inlet and discharge connections. Four anchor bolts hold the unit to the concrete slab, and the entire unit, with the exception of the upper few feet, is buried beneath the ground.

feet in diameter, and in height from 8 to 25 feet. Each complete shop-assembled and tested package consists of three basic sections—a storage chamber, an equipment chamber and an entrance tube, as illustrated in the accompanying line drawing. When the unit has been positioned on a bed of concrete, and anchored, it is only necessary to connect electric utilities, and intake and discharge piping before the package is ready to go to work.

Entrance Tube

The entrance tube is cylindrical and is constructed of $^1/_4$-inch structural steel plate. Its upper few feet are all that can be seen when an installation has been completed. The tube has a flat top that rests on a sponge rubber gasket. It is made of 11-gauge steel, with an 18-gauge polished stainless steel reflector surface to ward off solar heat. This reflecting surface and the top of the tube are further separated by 3-inch-high cooling vanes that aid in ventilation of the equipment chamber. (Some units are equipped with a $^1/_3$-hp ventilation blower capable of handling 330 cfm of air for forced ventilation.) Because of the weight of the cover, which totals 100 pounds on most models, a specially designed heavy-duty helical spring has been incorporated in the hinge mechanism as a safety factor. It requires only 3 pounds pressure to lift the cover. After unlocking and opening the lid, one has but to climb down the enclosed metal safety ladder to gain access to the equipment chamber and its group of compactly placed components.

EJECTORS BEFORE SHIPMENT

Standing outside Schmieg's Detroit plant, two ejector stations are ready for shipment. The unit in the foreground is 8×18 feet in size, and the other is 8×17 feet. At the base can be seen the plate for anchoring the unit to the subterranean concrete foundation. Above the base is the air receiver and sewage chambers; and above the chambers are the duplex inlet connections which project through the equipment chamber. The entrance tube, which has a smaller diameter than the equipment chamber, has not been attached but is shipped separately.

Equipment Chamber

Beneath the entrance tube and above the air and sewage chambers, lies the equipment compartment. It is attached to the tube above and balloons out from it. The walls are of double welded $^1/_4$-inch steel plate, and the top is fabricated of $^3/_8$-inch steel reinforced with 8-inch channels. Equipment in this section is divided into two basic categories: the compressors (usually two) and the automatic controls. The compressors are manufactured by Ingersoll-Rand Company and are single-acting, single-stage, air-cooled reciprocating Type 30's, ranging from 2 to 15 hp. They are V-belt driven from squirrel cage induction motors, regulated by automatic start-stop control. The compressors unload each time they stop.

To make the ejectors operate as efficiently as possible without excessive attendance, Schmieg mounts the motors on self-adjusting belt tension bases. These supports are such that if the tension in the vee belt becomes excessive, the motor is pulled toward the compressor. This releases the tension, thereby preventing excessive wear or burning of the belts.

The controls are essentially electric, and are mounted and wired compactly in a steel control cabinet. They are the key to the operation. The majority of the controls are bolted to the back of the cabinet; some are mounted on the inside of the front cover. Included are circuit breakers, a manual-automatic selector switch, a transformer, an electric receptacle that can be used for tools should maintenance work be required, starters, and the like.

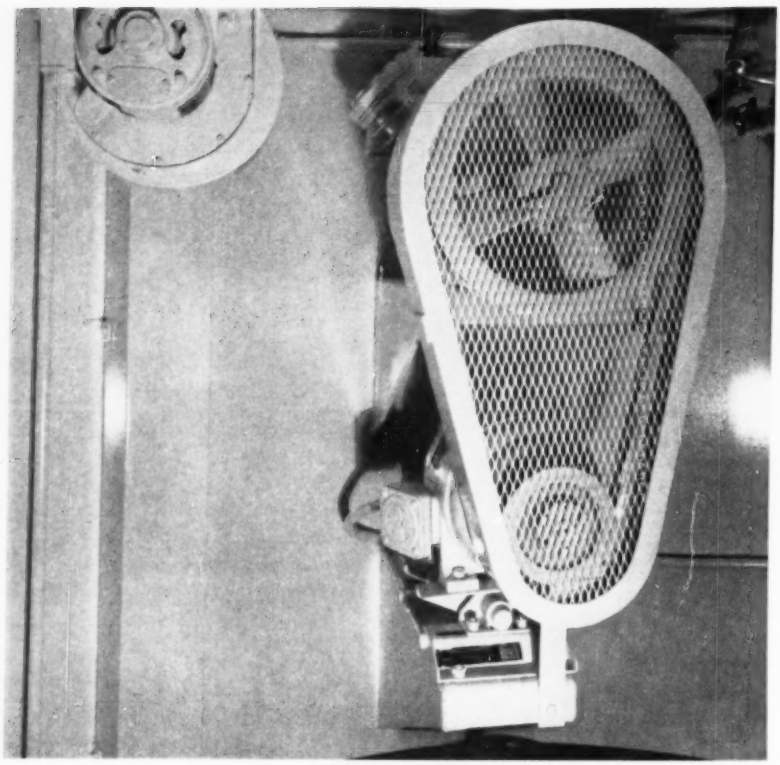
Chief among the controls is a replaceable alternator that switches the operation of the two compressors back and forth. It has a plug-in base similar to that of a radio tube. Since only one compressor is needed to empty the sewage during each cycle, the other remains on stand-by duty. By using the alternator, one unit operates during a cycle while the other remains on stand-by. During the next cycle, the stand-by unit becomes the operating one, and the other remains idle. The following cycle duplicates the first, and so on. In this way, both compressors are utilized effectively and efficiently.

Ejection cycles are not regular, but are controlled by demand. During morning and evening rush hours in a typical community, the compressors may alternate every 30 minutes. For the rest of the day, they may be off hours.

Storage Chamber

At the base of each Centri-Lift are the air and sewage cavities which together make up the storage chamber. Every ejector has one air receiver and may have one or two sewage pots, depending on the model.

The air receiver consists of two pressure heads and a cylindrical wall, the height of which is determined by the re-



COMPRESSED AIR SOURCE

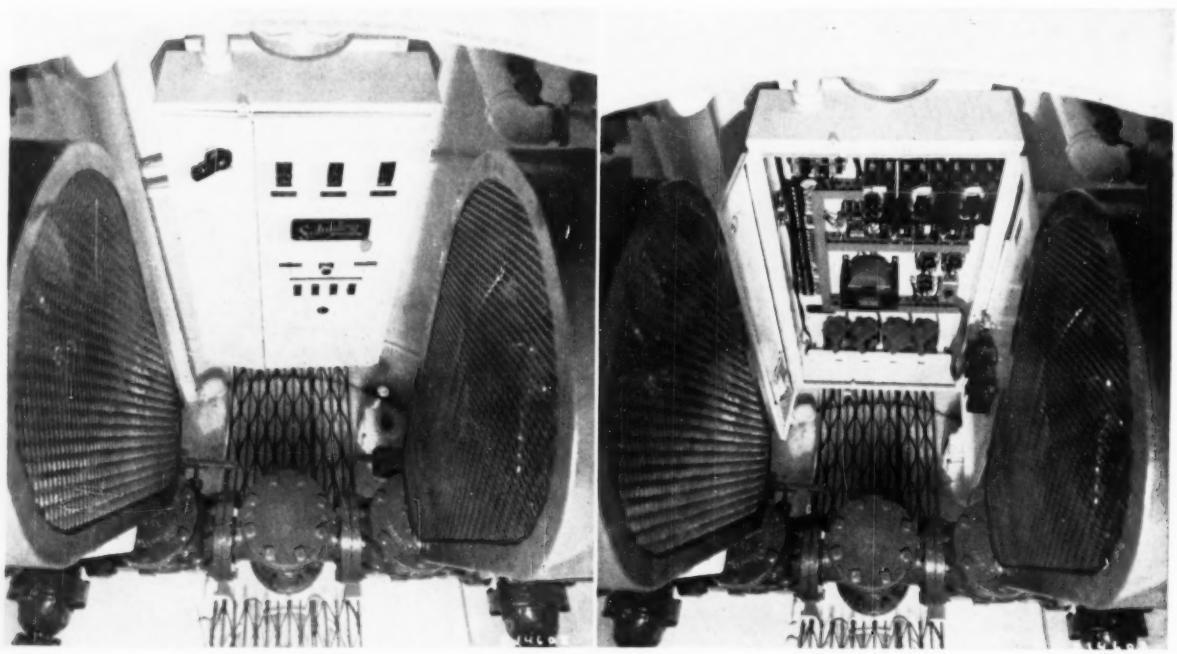
The photograph above shows an Ingersoll-Rand Type 30 compressor mounted in a typical ejector station. It is V-belt driven by an induction motor mounted on a self-adjusting belt tension base. In all units, the motor is mounted below the compressor.

quired air storage capacity. Safety features include a pressure relief valve in the air supply line and a muffled rupture disk in the steel head of the receiver. The receiver itself is fabricated of steel, designed in accordance with American Society of Mechanical Engineers code for unfired pressure vessels.

The steel sewage pot is welded to the air chamber heads, and is located inside the air receiver.

Two liquid level electrodes, one of which is longer than the other, extend into the sewage pot. As the sewage rises along the longer, air is vented to atmosphere through a 3-way valve until contact is made with the shorter electrode. This completes an electrical circuit which in turn activates a 3-way solenoid valve. The valve which had been venting air from the top of the sewage pot is automatically closed. Air at a pressure of 60 psig is delivered to the sewage pot, forcing the sewage up and out. A check valve in the discharge line prevents it from re-entering. Depending on the size of the unit, sewage may be ejected at a rate of 10 to 200 gpm or more.

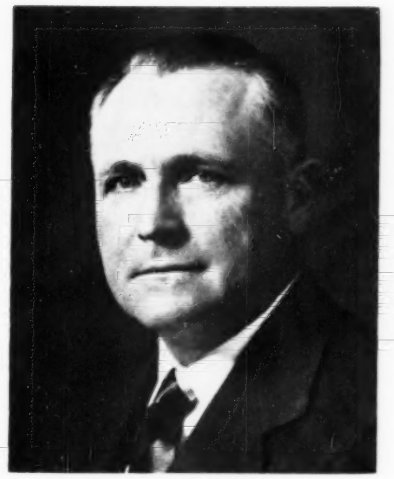
When the discharge has been completed and the sewage level falls below the longer electrode, the solenoid is reactivated, returning the 3-way valve to its original position. The compressor shuts off and unloads. New sewage can again enter the emptied pot, and the cycle begins anew.



EQUIPMENT CHAMBER

These two photographs show the two Type 30 compressors and the Schmieg-designed automatic control cabinet as they appear from the entrance tube. As can be seen, most of the controls are mounted and wired on the rear of the cabinet. The compressors operate alternately, each acting as stand-by for the other.

Moles Will Honor Denny, Drake



William Denny

George M. Drake

THE MOLES, an association of men engaged in heavy construction, will present its annual awards for the twentieth time next month. The awards, often termed the highest honor the construction industry can bestow, are traditionally awarded to both a member, and a non-member of the group. The awardees are William Denny, the member honoree, and George Morgan Drake, the non-member.

William Denny is called by his associates and colleagues a true "construction stiff," for his career spans more than 40 years in the field. Denny worked his way through the ranks starting out at eighteen as a fireman on a steam rig with Missouri Valley Bridge & Iron Company, Leavenworth, Kan. He joined Merritt-Chapman & Scott in 1927 and has remained with that firm ever since. Today, he is executive vice president and as such has over-all responsibility for more than $550 million worth of projects covering every field of heavy construction. M-C & S spreads are in countries throughout the world. Denny's firm is now engaged in work on the three largest competitively bid contracts ever awarded a single contractor

Glenn Canyon Dam, Priest Rapids Dam and the main generating plant of the Niagara Power Project.

George Morgan Drake also began his career in construction at an early age. Working as a teamster in the Dakota Badlands during construction of the Milwaukee Road's mainline track, he became determined to be an engineer. Graduating from the University of Minnesota in 1911, he had only 3 years of experience before starting a construction company in partnership with Messrs. Johnson and Piper. Six years later the partnership became Johnson, Drake & Piper, Inc., with Drake as chief operating executive, a position he has held since. The firm was one of the pioneers of modern-day highway construction techniques and also specialized early in airport development. Under Drake's leadership, the firm continued to grow even through the depression years, and when World War II came along, the firm found its services in demand for the construction of airports and other military facilities the world over. Even today the firm has many of this type contract, including the famed Distant Early Warning (DEW) line.

ANOTHER SPECIAL DRILL RIG AT NIAGARA

Shown in this illustration is one of three unique drilling rigs now being utilized on the Niagara Power Project. They are designed to drill anchor bolt holes for concreting the twin 46-foot-wide by 66-foot-high cut-and-cover conduits that carry water from above Niagara Falls to the powerhouse on the downstream side. On straight sections of the conduits, the anchor bolt holes are spaced on 8-foot horizontal centers and 6-foot vertical centers. The first row of holes is 4½ feet from the floor line and is drilled with Crawl-IR crawler-mounted drills. The remaining holes, the top one of which is 40½ feet from the floor, are drilled two-at-a-time with the rig shown. Holes are 8 feet deep and dip 30 degrees from horizontal. The cage rides up and down between guides, powered by an I-R air motor. One of the units is equipped with a 900-cfm Gyro-Flo portable compressor while the other two have 600-cfm Gyro-Flo rotaries. Two are equipped with D-45 drills and one, with a pair of X-71 drifters. Three-inch holes are drilled. The cages carry a driller and his helper and are also used for washing the holes, placing the anchor bolts and grouting them into place. An article detailing the over-all job and describing other special drill rigs used on the project appeared in the January issue.

WITH THE current emphasis on science, a great deal of interest has been aroused in its history and in the lives of some of its more obscure researchers and thinkers. Most historians now feel that each of these early thinkers may have contributed a great deal to the development of the methods of science, even though some of their theories turned out to be quite wrong.

James Ferguson was born in 1710 in the north of Scotland. He earned his early livelihood by drawing and painting, later becoming interested in science. Eventually he rose to a position of influence among educators of his day. He lived for 30 years in London and was a lecturer at the royal court. We present here his thoughts on pneumatics along with certain experiments he believed proved his theories. The material was found in a book entitled *Ferguson's Lectures on Select Subjects in Mechanics, Pneumatics, Optics and Astronomy.* It was published in 1825 by Sherwood & Co., London and, according to the publisher, was "adapted to the present state of science by C. F. Partington."

FERGUSON ON AIR

Dedicated to His Royal Highness, Prince Edward,
Sir,

"As heaven has inspired your Royal Highness with such a love of ingenious and useful arts, that you not only study their theory, but have often condescended to honour the professors of mechanical and experimental philosophy with your presence and particular favour; I am thereby encouraged to lay myself and the following work at your Royal Highness's feet; and at the same time beg leave to express that veneration with which I am, sir, Your Royal Highness's most obliged and most obedient, humble servant.

James Ferguson

ALL COMMON AIR is impregnated with a certain kind of *vivifying spirit* or quality, which is necessary to continue the lives of animals: and this, in a gallon of air, is sufficient for one man during the space of a minute, and not much longer.

This spirit in air is destroyed by passing through the lungs of animals: and hence it is, that an animal dies soon after being put under a vessel which admits no fresh air to come to it. This spirit is also in the air which is in water: for fish die when they are excluded from fresh air, as in a pond that is closely frozen over. And the little eggs of insects, stopped up in a glass, do not produce their young, though assisted by a kindly warmth. The seeds also of plants mixed with good earth, and inclosed in a glass, will not grow.

This enlivening quality in air, is also destroyed by the air's passing through fire; particularly charcoal fire, or the flame of sulphur. Hence, smoking chimneys must be very unwholesome, especially if the rooms they are in be small and close.

Air is also vitiated, by remaining closely pent up in any place for a considerable time; or perhaps, by being mixed with malignant steams and particles flowing from the neighbouring bodies; or lastly, by the corruption of the vivifying spirit; as in the holds of ships, in oil-cisterns, or wine cellars, which have been shut for a considerable time. The air in many of them is sometimes so much vitiated, as to be immediate death to any animal that comes into it.

Air that has lost its vivifying spirit, is called *damp*, not only because it is filled with humid or moist vapours, but because it deadens fire, extinguishes flame, and destroys life. The dreadful effects of damps are sufficiently known to such as work in mines.

If part of the vivifying spirit of air in any country begins to putrify, the inhabitants of that country will be subject to an epidemical disease, which will continue until the putrefaction is over. And as the putrefying spirit occasions the disease, so if the diseased body contributes towards the putrefying of the air, then the disease will not only be epidemical, but pestilential and contagious.

The atmosphere is the common receptacle of all the effluvia or vapours arising from different bodies, of the steams and smoke of things burnt or melted; the fogs or vapours proceeding from damp watery places; and of the effluvia from sulphureous, nitrous, acid, and alkaline bodies. In short, whatever may be called volatile, rises in the air to greater or less heights, according to its specific gravity.

When the effluvia which arise from acid and alkaline bodies meet each other in the air, there will be a strong conflict or *fermentation* between them; which will sometimes be so great, as to produce a fire; then if the effluvia be combustible, the fire will run from one part to another, just as the inflammable matter happens to lie.

Any one may be convinced of this, by mixing an acid and an alkaline fluid together, as the spirit of nitre and oil of cloves; upon the doing of which, a sudden ferment, with a fine flame, will arise; and if the ingredients be very pure and strong, there will be a sudden explosion.

Whoever considers the effects of fermentation, cannot be at a loss to account for the dreadful effects of *thunder* and *lightning:* for the effluvia of sulphureous and nitrous bodies, and others that may rise into the atmosphere, will ferment with each other, and take fire very often of themselves; sometimes by the assistance of the sun's heat.

If the inflammable matter be thin and light, it will rise to the upper part of the atmosphere, where it will flash without doing any harm: but if it be dense, it will lie near the surface of the earth, where taking fire, it will explode with a surprising force, and by its heat rarefy and drive away the air, kill men and cattle, split trees, walls, rocks, &c. and be accompanied with terrible claps of thunder.

The heat of lightning appears to be quite different from that of other fires; for it has been known to run through wood, leather, cloth, &c. without hurting them, while it has broken and melted iron, steel, silver, gold, and other hard bodies. Thus it has melted or burned asunder a sword, without hurting the scabbard; and money in a man's pocket without hurting his clothes; the reason of this seems to be, that the particles of *that* fire are so fine, as to pass through soft bodies without dissolving them; whilst they spend their whole force upon the hard ones.

It is remarkable, that knives and forks which have been struck with lightning have a very strong magnetical virtue for several years after; and I have heard that lightning striking upon the mariner's compass, will sometimes turn it round; and often make it stand the contrary way, or with the north pole towards the south.

Much of the same kind with lightning, are those explosions, call *fulminating* or *fire-damps*, which sometimes happen in mines; and are occasioned by sulphureous and nitrous, or rather oleaginous particles, rising from the mine, and mixing with the air, where they will take fire by the lights which the workmen are obliged to make use of. The fire being kindled will run from one part of the mine to another, like a train of gunpowder, as the combustible matter happens to lie. And as the elasticity of the air is increased by heat, *that* in the mine will consequently swell very much, and so, for want of room, will explode with a greater or less degree of force, according to the density of the combustible vapours. It is sometimes so strong as to blow up the mine; and at other times so weak, that when it has taken fire at the flame of a candle, it is easily blown out.

Air that will take fire at the flame of a candle may be produced thus. Having exhausted a receiver of the air-pump, let the air run into it through the flame of the oil of turpentine; then remove the cover of the receiver, and holding a candle to that air, it will take fire, and burn quicker or slower, according to the density of the oleaginous vapour.

When such combustible matter, as is above-mentioned, kindles in the bowels of the earth, where there is little or no vent, it produces *earthquakes*, and violent storms or hurricanes of wind when it breaks forth into the air.

An artificial earthquake may be made thus. Take 10 or 15 pounds of sulphur, and as much of the filings of iron, and knead them with common water into the consistence of a paste: this being buried in the ground, will, in 8 or 10 hours' time, burst out in flames, and cause the earth to tremble all round at a considerable distance.

From this experiment we have a very natural account of the fires of mount *Aetna*, *Vesuvius*, and other volcanos, they being probably set on fire at first by the mixture of such metalline and sulphureous particles.

The elastic air which is contained in many bodies, and is kept in them by the weight of the atmosphere, may be got out of them either by boiling, or by the air-pump, as shewn in the 25th experiment; but the fixed air which is by much the greater quantity, cannot be got out by distillation, fermentation, or putrefaction.

If fixed air did not come out of bodies with difficulty, and spend some time in extricating itself from them, it would tear them to pieces. Trees would be rent by the change of air from a fixed to an elastic state, and animals would be burst in pieces by the explosion of air in their food.

Dr. Hales found, by experiment, that the air in apples is so much condensed, that if it were let out into the common air, it would fill a space of 48 times as great as the bulk of the apples themselves; so that its pressure was equal to 11776 pounds, and in a cubic inch of oak, to 19860 pounds against their sides. So that if the air was let loose at once in these substances, they would tear every thing to pieces about them with a force superior to that of gunpowder. Hence, in eating apples, it is well that they part with the air by degrees, as they are chewed, and ferment in the stomach, otherwise an apple would be immediate death to him who eats it.

The mixing of some substances with others will release the air from them, all of a sudden, which may be attended with very great danger. Of this we have a remarkable instance in an experiment made by *Dr. Slare;* who having put half a dram of oil of carraway seed into one glass, and a dram of compound spirit of nitre in another, covered them both on the air-pump, with a receiver, six inches wide, and eight inches deep, and then exhausted the air, and continued pumping until all that could possibly be got both out of the receiver, and out of the two fluids was extricated, then, by a particular contrivance from the top of the receiver, he mixed the fluids together; upon which they produced such a prodigious quantity of air, as instantly blew up the receiver, although it was pressed down by the atmosphere with upwards of 400 pounds weight.

PHOTO PROCESSING
Alves Photo Service, Inc., uses compressed air throughout its film processing plant for everything from stirring chemicals to clean-up operations.

Oil-Free Compressed Air:

Handyman For Film Processor

THE NUMBER of time- and money-saving jobs that can be done with compressed air is limited only by the ingenuity of the people using it. History has proved this with the number of compressed air oddities that have appeared through the centuries. Daily case histories are adding their share to the proof.

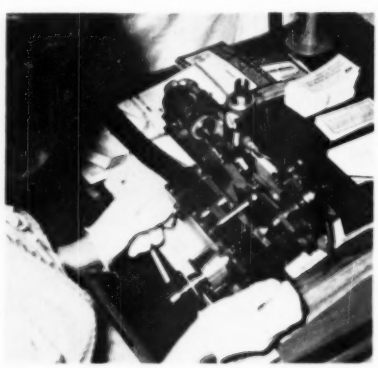
Alves Photo Service, Inc., Braintree, Mass., is a prime example of the multitudinous jobs that can be done with a single, nonlubricated compressor installed in a central location. The oil-free compresssed air is used to stir chemicals, dust negatives, clean slides, actuate accessory equipment, power artists' retouch air brushes and the like. It is vital that the air be completely free from compressor lubricants, for if it were not, chemicals could become contaminated; negatives, transparencies, paper and film could become spotted; and a myriad of other troubles could arise to devalue the established quality of the company's processing work.

At one time, several of the jobs done by the present centralized compressed air system were performed by either bottled gas or small, individual compressors mounted on the processing equipment. Both methods had their drawbacks. Bottled gas was not only a nuisance to replace, but presented a constant capital expenditure. The small individual compressors were particularly noisy and annoying to women engaged in nearby packaging and mounting operations. With scattered installations, routine inspection and maintenance were also headaches.

By centrally locating a single compressor, these problems have been eliminated. Employee morale has improved with the betterment of the working conditions. Equally important, pneumatic process equipment can be ordered "minus auxiliary compressors," which reduces new equipment costs. Furthermore, maintenance, routine servicing and inspection have been considerably simplified.

Air is furnished throughout the facility at a nominal 60-psig pressure by an Ingersoll-Rand Type 30 Model 235 HNL compressor. It is a watercooled, 2-cylinder unit with nonlubricated cylinders. Nonlubricated does not mean, however, that the compressor runs without oil, but rather that the cylinders are of special design and construction so that the air discharged is oil-free. In a standard compressor, cylinder walls and piston rings are lubricated with oil to minimize wear. Some of this lubricant is picked up by the air and is carried with it through the lines. In the self-lubricating Type 30's, carbon piston rings are used.

Oil-free air is also possible because of the piston design. It is elongated, and the lower end is splash lubricated. The lower part of the piston contains a conventional compression scraper ring and an oil relief groove with drain holes below the ring. This section supports the upper and middle portion, which is tapered. The top of the piston forms the support for the carbon rings and does not touch the cylinder wall. The elongation is such that the top and bottom sections of the piston are spaced so as to prevent overlap in their travel. This leaves a safe margin between the dry and the oiled sections of the cyl-



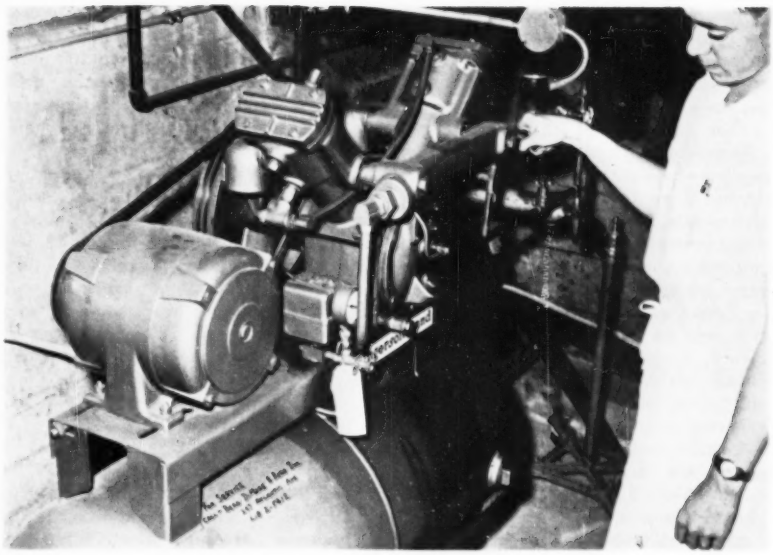
CUTTING WITH AIR
This specially designed, pneumatically operated cutter and mounter for transparencies is capable of fine adjustment. Alves has encountered little trouble since its installation, in contrast to a mechanical cutter that was previously used.

inder wall. Air pressure between the top and bottom of the piston further prevents any oil from rising to the dry section of the cylinder, pressing it constantly back toward the crankcase.

During compression, the air is cooled by water jackets around the cylinders. Then it is further cooled in an aftercooler, leaving the final discharge not only oil-free, but relatively dry (unsaturated).

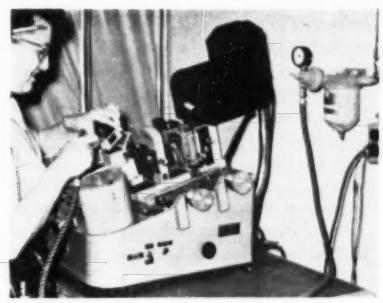
Among the many time-saving uses for air is a specially designed, pneumatically operated cutter and mounter for transparencies. It was found that a mechanical cutter was difficult to adjust, and it proved to be a constant source of down time. Alves had a simple, pneumatically driven cutter built—one that is capable of fine adjustment.

Improved quality is constantly achieved with the aid of pneumatics. In duplicating slides, a camel's hair brush is commonly used to sweep away dust particles that adhere to the surface. Once in a while, a brush will scratch the slide. Now, dust is removed with a blast of air, and the operator knows there is no danger of damaging the original slide with entrained oil. These are just two of the many air applications at Alves, and are illustrated on this page. Others are proposed, and because of the forethought in planning an ample centralized air system, should not require additional compressor installations spotted around the work areas.



CLEAN AIR

Oil-free compressed air is supplied by this nonlubricated Ingersoll-Rand Type 30 compressor. The attendent is adjusting the water flow through the aftercooler. By passing the air through it, excess moisture is removed.



AIR FOR BRUSHES

Pneumatically cleaning negatives and slides before printing or duplicating eliminates the problem of scratching the negatives. Oil-free air prevents spoilage from spattering. Drier air is further assured by placing the Fulflo filter in the air line.

This and That

Engineering Award For A Non-Engineer

The highest honor that engineers can bestow, the John Fritz Medal, will be awarded to a man with a non-engineering background for the first time in the 58-year history of the gold medal. Gwilym A. Price, chairman of the board of Westinghouse Electric Corporation, will be the recipient. The annual presentation for notable scientific or industrial achievement, this year based on Price's "vision and industrial leadership in the development of atomic power", will be made before the American Society of Mechanical Engineers when it meets this month. The award was voted by representatives of the American Society of Civil Engineers, the American Institute of Mining, Metallurgical & Petroleum Engineers, the ASME, and the American Institute of Electrical Engineers. Under Price's direction, Westinghouse designed the nuclear propulsion plants for virtually all the U. S. Navy's atomic fleet; consulted in the design of the first full-scale atomic-electric generating station, at Shippingport, Pa.; and helped to build other atomic power plants. The award was established by the engineering societies in memory of John Fritz, of Bethlehem, Pa., one of America's pioneers in iron and steel work. He received the first medal in 1902. Other distinguished recipients have been Lord Kelvin, George Westinghouse, Alexander Graham Bell, Thomas A. Edison, Orville Wright and Herbert Hoover.

☆ ★ ★

Engineers Revamp Shoelaces

Thongs, or shoelaces, have been worn since earliest recorded time. Innovations have taken place principally in materials, rather than in mechanics, however. Original materials used were leather and grass. Then came cotton, followed in recent times by rayon and nylon. One mechanical departure, nevertheless, was made. Footwear called the "knob sandal" was introduced in India and Persia long ago. Shoemakers fastened a large wooden knob to the sandal's upper sole, positioning it to protrude between the wearer's first and second toes. Though wearers managed to keep the sandals on

by gripping the knob between the toes, the method was high on the discomfort index of the day. Customer complaints disallowed this circumvention of the shoelace, and shoemakers returned to their conventional leather and grass.

Then, for hundreds of years, the shoelace has avoided the eye of the engineer. He has been busy providing mankind with wheels, turbines, automobiles, rockets and missiles, while his shoelaces have snapped in the morning and untied themselves on downtown streets. Now, the Du Pont Company has struck a blow for shoe wearers with its process for producing Taslan textured yarns. Previously, nylon shoelaces were slippery and often came untied. The new texturing process promises laces that will remain tied until the owner wants to remove his shoes, giving them added life at the same time.

In processing, the nylon yarn is exposed to a jet of air under high pressure. This air turbulence adds bulk and alters the texture, thereby removing the slipperiness found in laces made from the untextured yarn. Such nonslip laces retain nylon's renown high strength and abrasion resistance, and have added elasticity, making the laces more comfortable to wear.

★ ★ ★

Metal Crystal Specimens

Much higher rates of strain-free cutting of metal crystals for laboratory specimens can be achieved by an electrolytic saw which has been described in an Office of Naval Research technical report. The usual chemical method is to cut the specimen by localized application of acid by a moving nonmetallic thread. The cutting rate is sometimes only a fraction of a millimeter per hour. The new means does not obsolete the chemical saw however, for it may be converted to an electrolytic one by substituting a metal wire cathode for the thread and passing a current from the specimen to the wire through an electrolyte which is flowed over the specimen.

★ ★ ★

Vacuum Melting Factory

A technique of melting metals in a vacuum is being used at the factory of Jessop-Saville Ltd., Sheffield, England. It keeps two furnaces busy. Together they form what is believed to be the largest vacuum melting plant in Europe. One furnace can melt titanium ingots as large as 24 inches in diameter and in excess of $2\frac{1}{2}$ tons; the other has a 600-pound capacity. The process reduces the total gas content of the metal. Tests have shown that, with air-melted steel, remelting in vacuum reduces the total oxygen, hydrogen, and nitrogen content of the steel from 600 parts per million to 200 parts per million. It minimizes the need for long immunization heat-treating necessary to avoid the danger of hairline cracking. The two furnaces will be particularly valuable in the production of turbine and compressor disk materials used in gas turbine aircraft engines. Tensile tests on vacuum-melted 12-percent chromium steel disks have given elongation values four times greater than those obtained on disks made from air-melted material. They will also be of importance in the production of ball bearings and ball race steels

★ ★ ★

One Part In Five Million

For the first time in its history, the National Bureau of Standards, U. S. Department of Commerce, has certified the accuracy of its length measurements, made on two commercial gauge blocks, to better than 1 part in 5,000,000. The measurements were made on a 16- and an 18-inch gauge block, both sent to the Bureau by Moore Special Tool Company. Each of the blocks was first compared with the working standards of the United States. Then each was measured in terms of wave lengths of light. The results obtained agreed to the nearest millionth of an inch or better for both blocks. These measurements also agreed to 2 microinches with independent measurements made by the National Physical Laboratory (England). Improved accuracy of NBS calibrations is the goal of a special research project aimed at service with certified accuracies of 1 part in 10,000,000 or better. The present routine service is 2 parts in 1,000,000.

★ ★ ★

Cornell Architects Go Below

An experimental site for the first ultramodern underground nuclear bomb-proof city in the United States will be located just 35 miles from the New York State capital of Albany. Prof. Frederick W. Edmondson from Cornell University, assisted by a group of 25 graduate architects, engineers and planners in the Department of City & Regional Planning, selected the communities of Middleburg, Schoharie and Cobleskill as the site because of limestone formations in the area that will make excavation of tunnels and large caverns for the shelters simpler.

A U. S. Navy plane made aerial photographs, and the Cornell group is indicating the type of soil, slopes, drainage, transportation systems and existing land use of the area from the pictures. The project tentatively includes protection for a community that can continue to function independently for 2 weeks in event of a nuclear war, while producing critical equipment for the United States war effort in a complete manufacturing plant, employing about 1500 workers underground. Included too will be comfortable, functional spacious shelters and even children's play areas.

Two types of construction will probably be used, one that utilizes boring into the side of a mountain or large hill, and the other scooping out large depressions in flat land, building the required structures, and the covering with earth. The project, which is planned as a model for subsequent attack-proof cities of the future, will be made available to State and Federal Civil Defense groups. It is tentatively planned that these units can be built throughout the United States at a cost of $8 billion.

★ ★ ★

Corrosion-Proof Pipe Is Aluminum

A 16-inch aluminum pipeline, believed to be the largest ever made of the light metal, will be installed for Superior Oil Company in Lake Maracaibo, Venezuela. The 1800-foot line will be laid in the lake as the suction intake for a fire protection pump at Superior's tank farm in the Altagracia area. It will connect with a steel line leading from shore to the farm. The system, designed by Pipeline Technologies Inc., Houston, Texas, will have a normal capacity of 2000 gpm. Reynolds Metals Company will supply 25,700 pounds of alloy 5083-H113 aluminum for the pipe which will have a wall thickness of $\frac{1}{4}$ inch. The piping will be fabricated by Graver Tank Corporation, East Chicago, Ind. The metal's corrosion resistance will permit installation in the lake without protective coating or wrapping. The pipeline also is to be equipped with an aluminum riser and intake flow screen.

★ ★ ★

Radar Aerial Mapping

A project to learn the radar reflectivity characteristics of various types of terrain by means of airborne radar is underway at Goodyear Aircraft Corporation's Litchfield Park, Ariz., plant. It is aimed at developing the art of radar mapping by which observers may "read" radar reflections to determine the type of terrain below. (Under surveillance in the current testing program have been marshes, forests, cultivated fields and deserts.) It is hoped that this system will be a suitable substitute for conventional aerial photography that is limited to periods of good light and visibility. The project utilizes

a method of reflection measurement that combines airborne radar with an economical and high-speed data gathering system. This is coupled with a ground complex of GEDA computers and other analysis equipment. The data gathering is being done in Navy P2V-3W aircraft equipped with calibrated strip mapping radar, several radar recorders and a conventional aerial mapping camera. The position of the aircraft, during data runs over predetermined paths, is known at all times by means of film taken with the aerial mapping camera and with identifying aircraft speeds registered on video recorders. Thus, all data can be correlated in the company's electronics laboratory by simply matching the identifying pulses as they appear on the video record with the corresponding aerial photographs.

★ ★ ★

Bombing Forest Fires

Six producers of newsprint are organizing a private air force in British Columbia. The group has purchased four Martin Mars flying boats that were retired by the U. S. Navy in 1956 and will use the craft for water-bombing forest fires. Each of the planes will be capable of dropping a 7800-gallon blanket of water. The fluid cargo will weigh 32 tons and should be sufficient to extinguish most small blazes, or at least retard their spread until ground fire fighters can arrive on the scene. The flying boats are to be fitted so that the planes can pick up water from lakes. A scoop will utilize the forward motion of the plane to ram water into tanks, much in the way that some steam locomotives were equipped to take on water on the run.

★ ★ ★

Airborne Fueling System

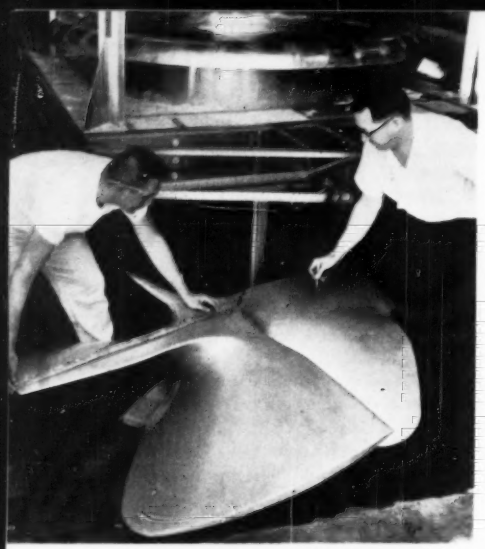
An air transportable hydrant fueling system that meets the strictest military requirements has been developed by Goodyear Tire & Rubber Company's Aviation Products division. It will accommodate 50,000 gallons of fuel in 10,000-gallon collapsible Pillow Tanks, and can be transported in one cargo plane along with all tools, applicable ground support equipment and personnel necessary for assembly and operation. Estimated time of erection is 12 hours. The system can provide recirculation, filtration and water removal for the initial supplying of fuel without having to waste or dump any fuel prior to servicing the first aircraft. Despite different mission requirements and varying topographical and climatic conditions, the system can be expanded or reduced in capacity without affecting its ability to deliver clean, dry fuel.

Controlling Furnace Gas Pressures

A 53,000-kw station that provides power for General Savio Steel Mill San Nicolas, Argentina, has a unique control sequence for monitoring blast furnace gas pressures for its 5-fuel boiler system. The turbine is driven by a twin-boiler installation equipped to successively fire coke breeze, blast furnace gas, coke oven gas, and both heavy and light fuel oil; and it has provision for future firing of pulverized coal in place of heavy fuel oil. The problem of accurately controlling the furnace gas feed was solved by Hagen Chemicals & Controls, Inc. The system is an electrical-electronic-pneumatic combination for rapid response and correction. Changes in blast furnace gas pressure levels are sensed by a variable-resistance transducer. A rectified voltage from a Zener diode is impressed across the transducer to produce a millivolt output proportional to variations in gas pressure. This output is amplified and transmitted to an electrical-pneumatic converter, which acts to shut off the flow of blast furnace gas when it falls below preset limits. Other controls automatically cut-in the next available fuel to the boilers. To minimize combustion hazards, automatic safety features were incorporated in a series of interlocks that prevent premature ignition of the main burners.

PLASTIC PLUGS FOR JETS

A lightweight, expandable plastic plug to protect jet engine intakes while the planes are on the ground has been developed by a Boeing Airplane Company employee and is being manufactured in Seattle, Wash. The device is equipped with an inner tube that can be inflated to fit any size jet engine intake, and it also covers oil cooler and air compressor intakes formerly requiring separate plugs. Previously used wooden plugs had to be shaped for each engine. Furthermore, they weighed ten times as much as, and cost nearly ten times more than the new plug.



TO PROVIDE LIFT

This specially designed propeller pumps a large volume of air beneath the aluminum flying platform. It gives sufficient lift to keep the vehicle about 2 feet above the water's surface. It can then travel at about 50 mph using little power, the result of an almost complete negation of friction.

Hydro-Air

Union of Ship and Plane

CENTER SECTION

The Hydro-Air vehicle is 32 feet long and 24 feet wide at its greatest point. When completed, it will be shaped like a teardrop.

STRENGTH AND BUOYANCY

Styrofoam is cut and fitted to the Spacetronics vehicle. After it is in place, liquid styrofoam is poured around it to form a solid installation.

THE FIRST full-scale flying platform, called Hydro-Air, was recently shown to the public by its manufacturer, Spacetronics, Inc. It is a vehicle that one day may swiftly carry cargo from one port of call to another, traveling above the water instead of through it as ordinary ships do. It will be supported in its voyages by a cushion of air.

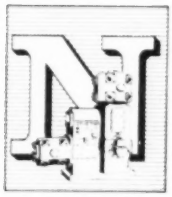
The unusual machine, as shown on this page, is built of aluminum extrusions and sheet. These make a lightweight metal frame which is then packed with styrofoam to provide buoyancy and additional strength. The platform is of teardrop shape, being 24 feet wide at its greatest section and 32 feet long. It stands 2 feet high. The Hydro-Air's horizontally rotating propeller is housed in the bow.

The volume of air, not the pressure, will keep the platform airborne. The Hydro-Air was designed so that the lift is provided by a plenum chamber that contains a billowing volume of air. This is opposed to annular jets that gain lift by directing a curtain of air at the water surface. The prop will pump and maintain the volume of air required. The air pressure needed is only a few ounces per square inch, but it is sufficient to keep the craft about 2 feet above the water surface. The maximum height reached by the flying platform is calculated as being approximately equal to one-tenth the equivalent diameter.

Once the machine rises above the water surface, friction is practically eliminated and the anticipated high speeds can be obtained with only a fraction of the power ordinarily required for conventional ships and aircraft. Propulsion is provided by aft-mounted fans.

EDITORIALS

About Resolutions



NEW YEAR'S resolutions are customarily associated with personal commitments. In their way they are valuable, even though in the press of day-to-day affairs, many are soon forgotten or forced aside by a variety of exigencies. They serve as a review of things past and a retooling of the mind, so to speak, to cope with days ahead.

Planned annual reviews of operations and a retooling to better deal with the future are necessary things in industry, too. With the pressure of increasing competition at home and abroad and with rising costs of land, labor and capital, practically every phase of business operations is coming under close scrutiny by cost-conscious engineers. We'd like to suggest that when year's end reviews are made, two very important elements of production be examined in the manufacturing industries.

COMPRESSED AIR systems should be checked with an eye for efficiency. Full-power plant air can do a great deal toward cutting costs by guaranteeing that the many cost-saving advantages of compressed air are fully obtained—that such things as inadequate compressor capacity, restrictive piping and leaks are not sapping expected benefits. The costs are threefold: first is the cost of high maintenance of overworked equipment; second comes the cost of wasted air—air that is compressed, but not used; and third, and most important, is the cost savings possible, but not realized, when pneumatic tools that should deliver great time and labor savings do not do so because they are underpowered.

Many aids are available to help in checking and revitalizing compressed air power systems. Some of these, which have appeared in COMPRESSED AIR MAGAZINE, are available as reprints. Manufacturers' engineering representatives can be called on for complete air system surveys, too.

PNEUMATIC TOOLS have a great many advantages that have often been detailed. Their low maintenance, high power in a small package, ect., coupled with means for controlling torque, for automatizing certain operations and for getting into tight places have won for them a widening circle of applications. With their growing importance to industry has come a need for better supervision of their use. Air engineering experts urge that portable pneumatic tools be given their fair share of the tool engineer's supervision—a share based on costs of the tools *and their operators*.

A planned annual retooling can take advantage not only of manufacturers' advances in improving the performance of old-line tools, but of completely new tools as well. It will weed out old equipment that has outlived its usefulness. Air engineering experts point out that a working tool is not necessarily an efficient one. Again, it is the cost savings possible with full-power, modern equipment that make it an expensive proposition not to devote time and effort to an annual study of portable pneumatic tools. In most cases, the cost of a tool is but a small percentage of the cost of the tool plus an operator. When the operator's output is held down by obsolete or underpowered tools, great savings—oftentimes amounting to getting the work of eleven or more men from ten—are possible by making moderate expenditures for new tools or for new or improved compressor facilities.

One manufacturer of air compressors and pneumatic tools terms these savings "dividends on payroll dollars." Dividends running into many thousands of dollars have been secured by following that manufacturer's established format for reviewing the operation of air compressors and the accompanying air system, and the power output and use factors of pneumatic tools. It seems to us a means by which a long-range goal of cutting costs and increasing efficiency can be attained.

The Holidays

HOLIDAY greetings are the theme of this season. There is considerable brightness and a tradition of good cheer in almost all lands. We'd like to add our greetings of the season and best wishes for the year to come.

We cannot help but notice, however, the constant admonitions of safety groups for care during the Holidays. We are warned that should carefree days turn to careless ones, grief and sadness may mar the season.

Our readers are in many industries, all of which are devoted to safety on the job. Their constant attention and training have made many occupations that once graced the "hazardous" list a great deal safer than the act of driving to work. Being safety conscious is not, and cannot be, an 8-hour-a-day attitude. Rather the outlook that makes a safe worker must carry over to off-job hours and days. The example set by these safety-conscious men and women on the highways and at home could very well have a salutary effect on those who have not had the advantages of intensive training by industries determined to prevent accidents on the job.

For Rocketry:

HIGH-PRESSURE VESSELS ARE

Familiar Sight Returned

HELIUM, which once found its principal use in dirigibles and other lighter-than-air craft, now has become an important ingredient of projects in this atomic and space age. As a result, there has been an increased demand for the rare gas, and Christy Park Works of U. S. Steel's National Tube Division has returned to production of an old and familiar item—high-pressure cylinders.

Christy Park Works is the sole supplier in the United States of high-quality steel cylinders used to transport helium over the nation's railroads. In the 1930's, the firm furnished the first such cylinders made in America, and since then has built all the vessels for the approximately 140 helium transport cars that have been in service. One of these is shown in the photograph reproduced below at the centerfold.

The U. S. Department of the Interior, which controls the production of helium, ordered an additional twenty cars similar to the 140 in use from the American Car & Foundry Division of A. C. F. Industries, Inc. Six hundred cylinders will be needed, for 30 of the high-pressure vessels, such as the ones shown below (left) will be fitted on each of the cars. Specifications call for cylinders of 18-inch diameter and 33-foot length. They are being fabricated from National Tube seamless manganese molybdenum alloy steel pipe. After the cylinders have been made and inspected, they will be shipped to American Car & Foundry for installation.

The helium transported in these reminders of days gone-by will be used as a back-up gas for liquid oxygen and other missile fuels. Under high pressure, it forces the fuels into missiles' engines. Because it is an inert gas, it does not affect the fuels themselves. This is an important consideration because the fuel must be metered into the engines in precise quantities to meet programmed flight specifications. In atomic energy plants, helium is utilized as a coolant for atomic piles.

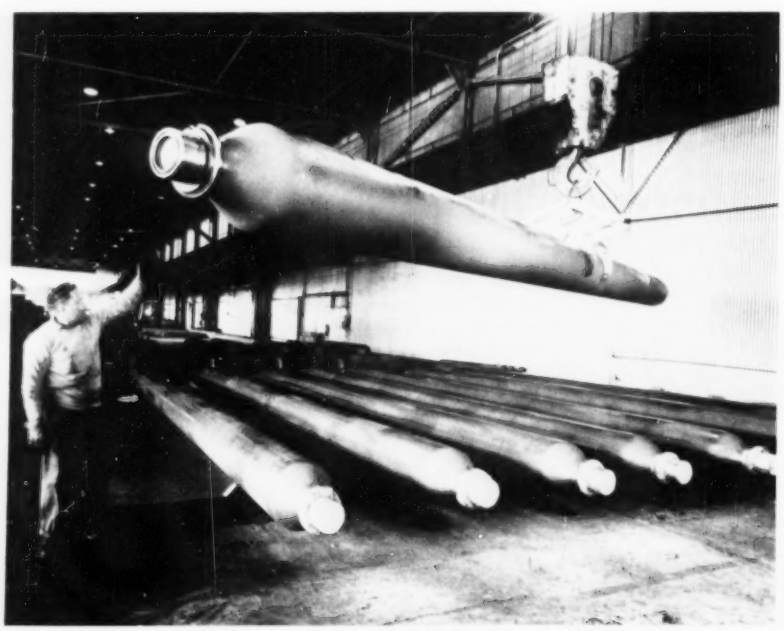
Unfamiliar Inspection Techniques

A NUMBER of high-pressure vessels of varying size and design will also be furnished by Christy Park Works for installation at each Atlas launching pad at Vandenberg Air Force Base, Calif. These will be interconnected by a manifold of stainless steel tubing. The containers will hold the high-pressure helium, nitrogen and oxygen that force liquid fuel into the missiles, and purge the fuel systems after firing.

Specifications require that interiors of the containers and their component parts be free of all hydrocarbons, and of any foreign particles larger than 150-micron (0.0059-inch) size.

To meet these exacting standards, Christy Park Works is conducting some of the steel industry's most detailed inspections. A variety of tools is used.

The interior of each vessel is examined visually with a long probe that carries a so-called black light. This reveals the presence of any hydrocarbonous oil or grease. (Such matter appears as a creamy white under the light's eerie purple glow.) A thin, stainless steel borescope is then thrust into the vessel, and by means of an optical eyepiece, the inspector obtains a magnified view of

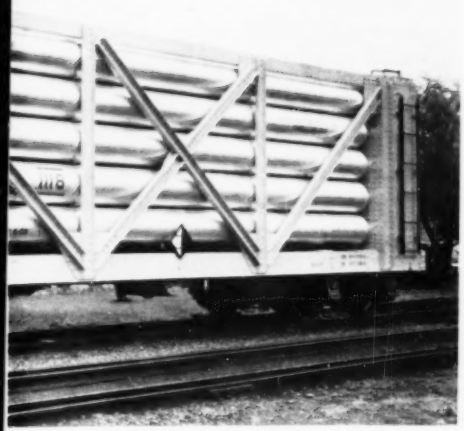


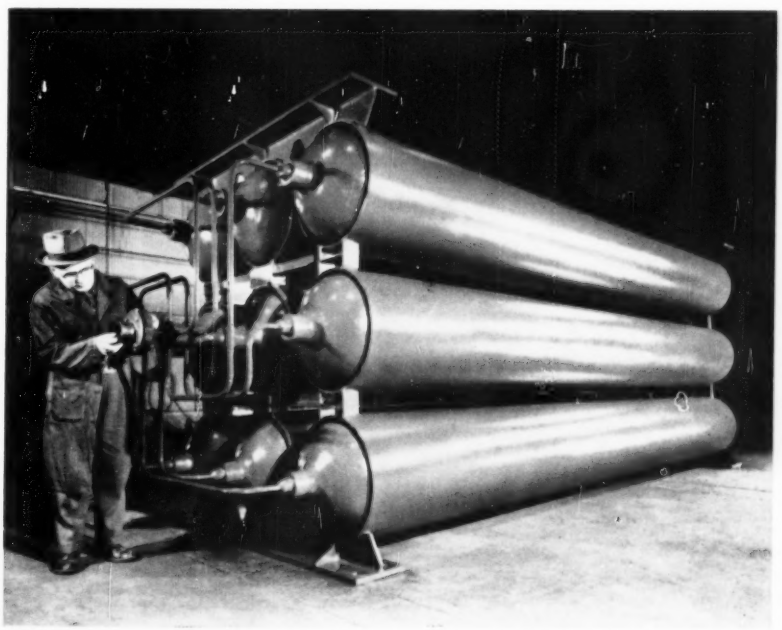
REQUIRED

the walls, and of any scale or other particles that might be present.

Since the bends in the stainless steel manifold tubing prevent visual inspection, a wipe test is conducted wherein a piece of filter paper is drawn through the entire length of the tubing. This operation is illustrated in the close-up at the right. When the paper is withdrawn, it is not only examined under a black light for oil or grease stains, but is inspected under a 10-power magnifier for particles as well. If any hydrocarbons or any foreign particles larger than the 150-micron limitation are found in the vessels or tubing, the entire component is recleaned.

National Tube is supplying the gas storage vessels under subcontract to Utah-Hardeman-Manhattan, which has the prime contract for the installation of high-pressure gaseous storage and process piping at Vandenberg. The work is being done under the supervision of the U. S. Army Corps of Engineers, which is responsible for the installation. The photograph at the bottom right shows an Army inspector making a final check on a typical bank of high-pressure vessels destined for the air force base.





SAVING
WITH
AIR POWER
APPLICATIONS

Polishing Tube Interiors

IN A MACHINE built by a Midwestern concern, compressed air pushes an expansible grinding head through long tubes to grind and polish them internally. The grinding head is mounted on a hollow, reciprocating ramrod—actually an unusually long air cylinder. Mattison Machine Works, Rockford, Ill., is the manufacturer; the unit is seen in the photograph below.

Grinding is not done directly by the head but by a traveling closed-loop abrasive belt that moves along inside the tubes. To make such a loop, an abrasive belt is first passed through the length of the tube. Then the two ends are glued and spliced under a hot press. This is a simple operation that takes only a few minutes.

During the grinding and polishing, the tube is revolved and the abrasive belt is in motion, while the expansible grinding head moves back and forth through the tube. This means the entire inner surface is uniformly ground. The work piece is horizontally supported during the operation by several sets of rubber-faced rollers. Three of these are installed at each point to hold the tube tightly.

The components of the machine can be moved toward or away from each other to process varying tube lengths. Also the water spray and trough that keep the tube cool are equipped with telescopic action for length adjustment. The machine will accommodate piping up to 50 feet long and from $^{5}/_{8}$-inch to 9-inches O. D., of almost any seamless or welded basic material.

Various grades of abrasive may be used to provide the specific interior finish needed. It is also possible to vary the speed of ram travel and the speed of revolution of the tube. And through a controlling valve, grinding pressure of the expansible head is adjusted.

Two main industry fields use such finely polished tubes. Dairy, food, drug and other companies that handle super-clean products destined for human consumption must have them. Also the clean pipes are placed in boilers or in oil-handling applications where deposits or scale may have a tendency to build up. A perfectly smooth tube interior deters any such deposition. Consequently, less frequent cleaning is needed. When deposits are removed from these tubes the cleaning is done more easily.

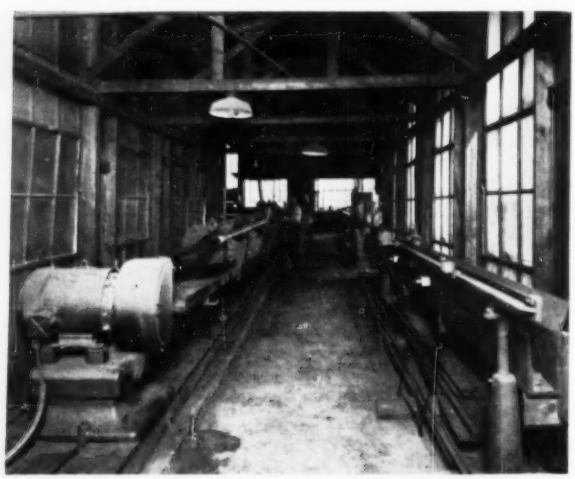
Positioning Dip-Painting Tanks

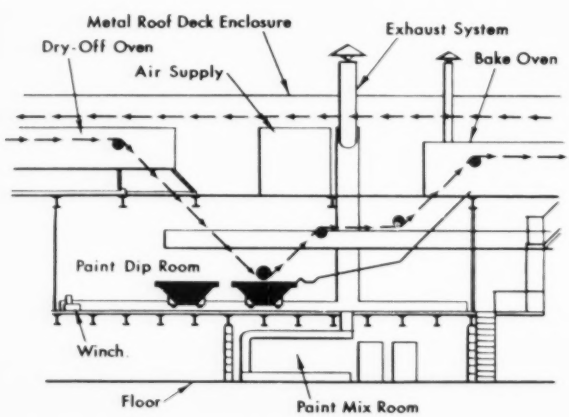
AN ILLINOIS plant of an electrical equipment manufacturer needed a more versatile method for changing colors in dip painting parts of low-voltage distribution systems. The drawing below shows the system that was designed by The R. C. Mahon Company's Industrial Equipment Division for the new Cutler-Hammer plant.

Two dip tanks containing paint are mounted on wheels and located at the lowest point of the conveyor system that carries the parts. When a change of paint color must be made, only a short 15-minute shutdown is required. During this period, dump line connections are disconnected, and an air-operated winch is put to work. It pulls the "old" tank away from the center position, then spots the second tank in place on the conveyor circuit. The air winch moves each tank about 12 feet. Only one worker is needed to break connections, move the tanks and hook up the system again. There is room for another tank should a third color ever be needed.

The tanks are 8 feet wide and 10 feet long; they hold 1000 gallons. The air-powered winch moves 15,000 pounds when a tank is budged—this includes the weight of the tank and the paint contents.

The new method of changing dip-painting colors is much simpler and faster than flushing out a single tank and adding a different color of paint, or shifting work from the production line to spray booths. Aided by compressed air, this elimination of down time adds to the productive time of the plant and makes its operation more efficient.



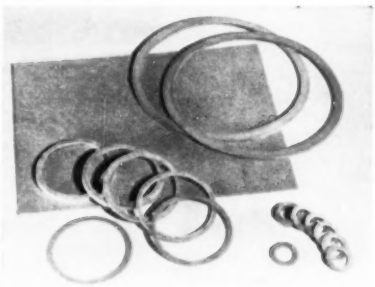


Industrial Notes.

PUROLATOR Products, Inc., is producing lightweight filters that are free of built-in contamination, with media elements locked together mechanically by a specially developed high-pressure process. The process, using special dovetailed construction, locks together all components of the filter element (including media, end caps, and center tube) so securely that the filter medium is embedded in the parent metal of the end caps to form a leak-proof seal. Since the process requires no welding, aluminum and dissimilar metals can be used in filter designs. Furthermore, fine wire mesh media are not subjected to the high temperatures produced in welding or brazing processes and thus are not contaminated by oxidation products, and the stainless steel is not heated to the critical zone that induces carbide precipitation. The pressure-locked units are designed for all types of filtration,

including oil, fuel, or pneumatic systems, and for any applications where wire mesh filter media of stainless steel, Monel, or phosphorous bronze are required or desired. Presently producing the filters with stainless steel wire mesh media elements, ranging in size from 1 to 1½-inch diameters, the manufacturer reports that it plans to apply the high-pressure process throughout its line of industrial process filters. Further information about these elements may be obtained by writing to the company. *Purolator Products, Inc.*, Department 108, Rahway, N. J.

CORK and silicone rubber have been combined for the first time into a single compound. The unique material,

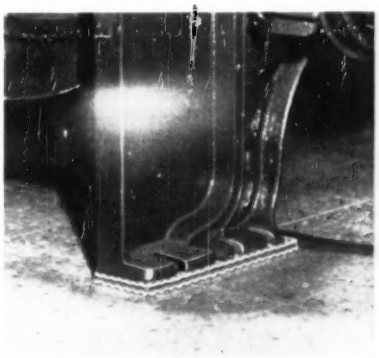


known as LC-800, provides the advantages of both materials. LC-800 reportedly allows the gasket designer to use cork and rubber gaskets at much higher temperatures than possible in the past. In addition to extending the temperature range of such materials, the compound is considerably less expensive than ordinary silicones. It can be made in ribbon and lathe cut rings, both extruded and laminated, as well as mats, sheets and die-cut parts. *Armstrong Cork Company*, Lancaster, Pa.

A COMPREHENSIVE brochure, Bulletin No. 426, portrays modern techniques for researching, developing and producing hermetically sealed components and assemblies for industry and the military. Reportedly, more than 30 years would pass before 1 cubic centimeter of air would penetrate the seals. It is claimed that such a hermetically sealed unit could outlast a similar unsealed unit by more than 10 to 1, under the same environmental conditions. Featured in the brochure is the manufacturer's production line arrangement for mass spectrometer leak testing, that can gauge leak sensitivity to 10^{-10} cubic centimeter per second. The publication explains that the manufacturer maintains service and production facilities that can produce single or volume quantities of components and assemblies, hermetically sealed against seven major causes of product failure: humidity, altitude, fungus, salt water spray, rain, explosive atmospheres, and dust. *General Hermetic Sealing Corporation*, 99 E. Hawthorne Avenue, Valley Stream, Long Island, N. Y.

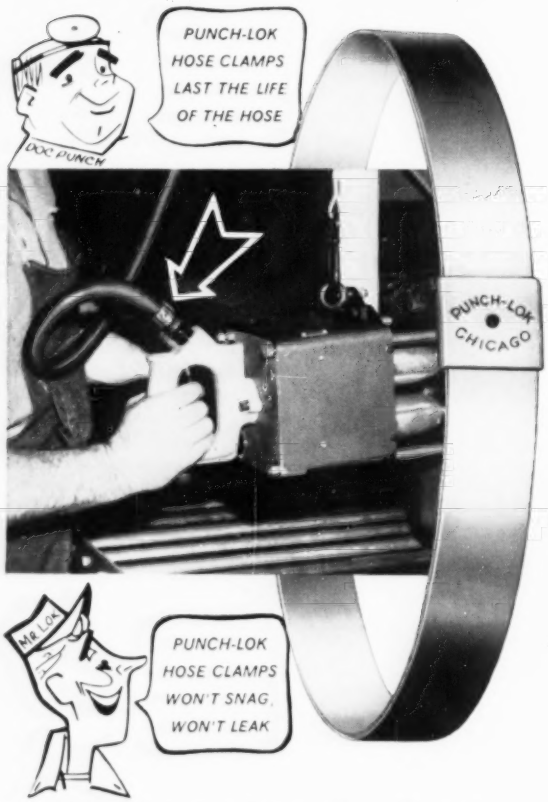
DESCRIBED as using a new concept, the Somat waste disposal system takes in refuse, chews it instantly into a compact pulp, renders it odorless without the use of chemicals, then discharges it to haulage containers. The system is the subject of a 12-page, 2-color brochure. The booklet points out hidden and known costs of conventional waste disposal and tells how Somat can cut these costs. Such features of the system as push-button control, automatic action, compactness, and low-cost maintenance and operation are explained and pictured. A photo-diagram shows stages of the Somat operation, and case histories and installation photographs are included. *Wandel Machine Company*, Pomeroy, Pa.

AN ANTIVIBRATION material is claimed by its manufacturer to absorb 90 percent of the vibrations and noise caused by machines. Vibra-Check is composed of elastomeric vinyl plastic completely reinforced with monofilament fiber glass. Fused in layers, under heat and high pressure, to an integrated unit, Vibra-Check is said to be durable, reusable, impervious to shock and oils, greases, detergents and solvent cleaners. The material isolates vibration by a combination of separate layers fused



into one. The outer layers are of a resilient low-density composition whereas the central core is a high-density hard structure. A vibrational wave thus meets three different natural frequencies, preventing resonance and isolating the vibration. Vibra-Check requires no bolts or adhesives for installation. The material is suitable for

small components do a BIG JOB!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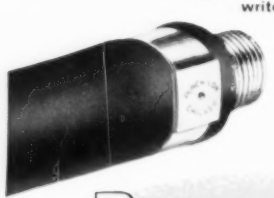

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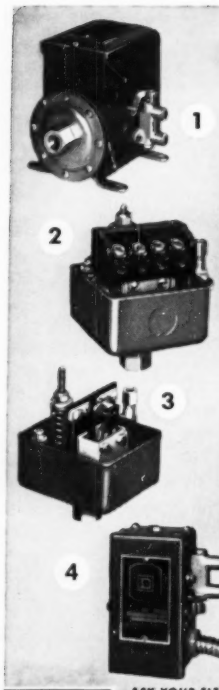

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IRVINE, WARREN COUNTY, PENNSYLVANIA

machines weighing from 100 pounds to 100 tons, reports the manufacturer. *Lowell Industries, Inc.*, Boston 34, Mass.

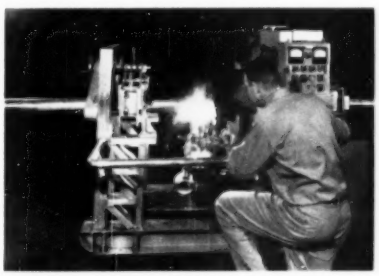
A CHEMICAL solvent, said to completely clean electrical motors of oil, grease, dirt and dust, is available in aerosol containers. Called Swish Elektrokleen, the solvent reportedly will also remove moisture from equipment that has been short circuited by water. Unlike most aerosol sprays that provide a mist, this solvent has a special nozzle that produces a far-reaching, concentrated drenching spray. The chemical will drain off and evaporate; in easily accessible areas it may be wiped off with cloth or absorbent paper. It is said to leave no residue. It is noncombustible and will extinguish flames. It is said to be nontoxic and noncorrosive. Besides motors and their parts, the solvent can be used on: generators, commutators, slip-rings, contact breaker points, switch mechanisms, power tools, fans, ducts, oil burners, typewriters and office machines and oil or grease spots on floors. *Montgomery Chemical Company*, Jenkintown, Pa.

A POCKET GUIDE has been published listing 350 films available to technical groups, business and professional audiences, clubs and the like. All of the motion pictures are of the 16-mm sound variety. They are lent free as a public information service of leading businesses and industries. Subjects range from summer and winter sports to electronic and technological advancements, from kitchen techniques and psychological dramas to U. S. history and government. Thirty regional film libraries distribute the pictures throughout the U. S. The booklet, *Pocket Guide To Free Films*, is available free of charge. *Modern Talking Picture Service*, 3 E. Fifty-fourth Street, New York 22, N. Y.

FOUR models of pneumatic power control drives, for positioning of regulating devices through mechanical linkage, are described in Product Specification P81-1. Producing torques from 50 to 2250 foot-pounds, the units are suitable for special high-temperature applications. Standard units are suitable for operation in ambient temperatures to 140° F, and they may be modified for use in temperatures to 250° F. They operate and position regulating devices such as dampers, fan inlet vanes, valves, turbine governors, reostats, levers and shafts. They are actuated by pneumatic signals from either automatic control or remote manual operation. Easy installation, quick change to hand or automatic operation and a highly protected mechanism are said to be among the unit's advantages. *Bailey Meter Company*, 1050 Ivanhoe Road, Cleveland 10, Ohio.

A PILOT-OPERATED temperature control valve incorporates a patented sliding gate and plate main valve. The unit has self-cleaning seats, an integral pilot with a filter screen, and oversized, clog-resistant passages. It produces a linear flow curve. A short stroke and the use of metal seats and metal diaphragms are said to give long service life with minimum maintenance necessary. Temperatures from 35° to 450° F can be controlled by the ten ranges of the unit that are available. Cast-iron flanged bodies of the valve are offered in $2\frac{1}{2}$- and 3-inch sizes for pressures to 250 psig. The device is described in the manufacturer's Bulletin JNP-2. *OPW-Jordan*, 6013 Wiehe Road, Cincinnati 13, Ohio.

PIPE WELDS produced without the use of back-up rings, and achieving sound joints with full penetration, are possible with a newly developed machine. The unit is said to complete a pass on 4-inch pipe in 11 seconds, and will handle all tubular products with



outside diameters of 4 to 11 inches. Head rotation of the device is closely controlled with a finely regulated motor. Maintenance is simplified with the instrument, which uses magnetic amplifiers and semiconductors instead of electronic tubes. A vapor-proof cabinet that contains all the electrical controls for the welder can be locked to safeguard against damage. *Aluminum Company of America*, 1501 Alcoa Building, Pittsburgh 19, Pa.

STRUCTURAL aircraft fasteners with 220,000-psi strength in 180,000-psi bodies make possible a fastener weight savings of about 33 percent. The lightweight bolts and nuts are modifications of an earlier 220,000-psi series specifically designed for use in steel and other high-strength members. According to the manufacturer, the fasteners are a result of the trend in aeronautical design toward higher hardness structural metals, such as aluminum alloys, stainless

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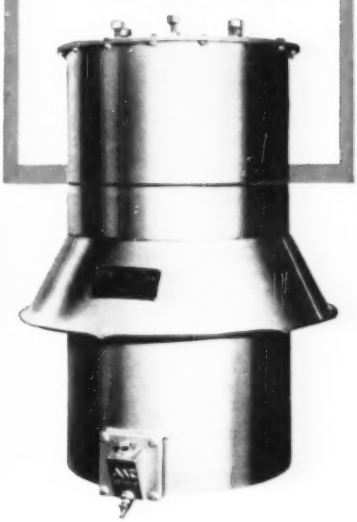

AAF Type "W" Cycoils have proved themselves in thousands of installations—even where dust conditions were most severe. High collection efficiency and virtually maintenance-free operation have made Type "W" Cycoils favorites in all industries.

The operation of the Cycoil is unique. A combination of oil impingement, centrifugal action, and filtration results in practically 100% dust removal in standard A.S.H.V.E. tests.

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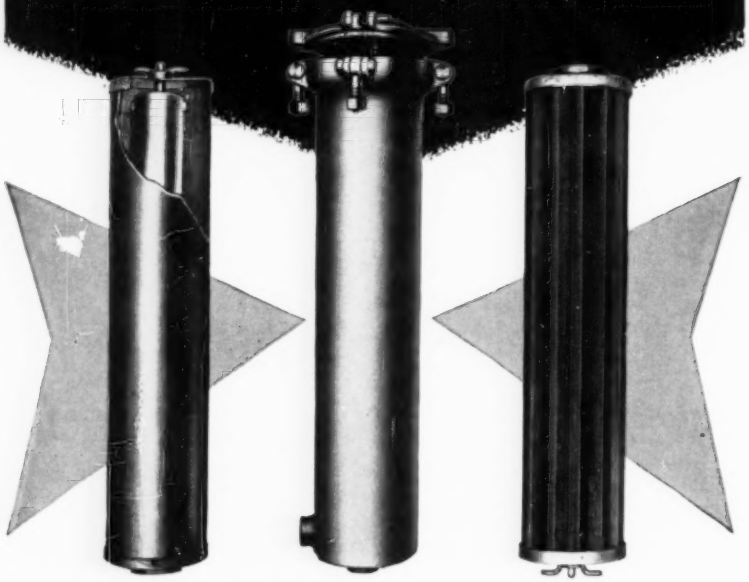

Figure 1554A-4L strainer basket available in brass, steel or stainless steel screen. 8 x 8 to 100 x 100 mesh.

Figure 1554-4L and Figure 1490DD-4L strainer shells are identical. Strainer baskets shown are interchangeable in this model.

Figure 1490CN-4L basket. Star-shape provides 20% more free screen area in this size. Available same metals, mesh as Fig. 1554A.

Nugent pipe line strainers can materially reduce your maintenance labor costs and hold down-time to a minimum. Unlike most strainers of this type, both the Nugent round basket and star-shaped extended area strainers, shown above, catch and hold their accumulation of foreign solids in the interior of the strainer basket.

Dirty liquid, under pressure, enters the strainer through the bottom inlet. It is then propelled upward through the center tube assembly. Emerging at the top, the liquid travels outward and downward, through the mesh of the basket and to the side outlet. In this manner, foreign solids are trapped *inside* the strainer basket which is then easily lifted from the outer shell for cleaning. A clean spare basket may be immediately substituted and the dirty basket cleaned when convenient.

Most other strainers direct the flow of dirty liquid from the exterior to the interior of the basket. Thus, foreign matter is trapped between the outer shell and the basket; not inside. When these dirty baskets are removed for cleaning, it is almost impossible to prevent some foreign matter from flowing back to the inlet and outlet piping. This type also requires scraping and cleaning the interior of the outer shell, a time consuming task that increases down-time.

Nugent strainers can save you time and money. For full details write for Bulletin 6.

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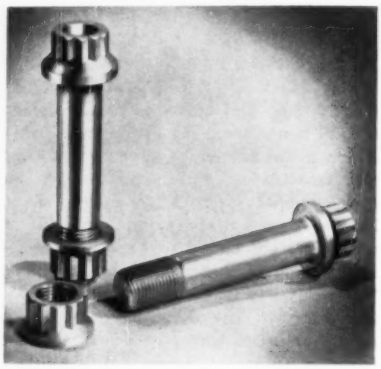


LWB 22; the units, FN 22. *Standard Pressed Steel Company*, Jenkintown, Pa.

ARC WELDING cable connections and accessories are described in a 12-page catalog, entitled Twecolog No. 12. The publication illustrates various ground clamps, electrode holders, cable and terminal connections and lists their specifications and prices. The connectors are said to be precision machined from hard-drawn brass, and have tough red fiber insulating sleeves. The holders named Twecotongs, are a highly conductive copper alloy with a powerful grip and interchangeable tip insulators. The ground clamps have a special ball-joint cable connection, a copper hinge pin that allows both jaws to carry current, and a strong, fully insulated spring. *Tweco Products, Inc.*, P. O. Box 666, Wichita, Kan.

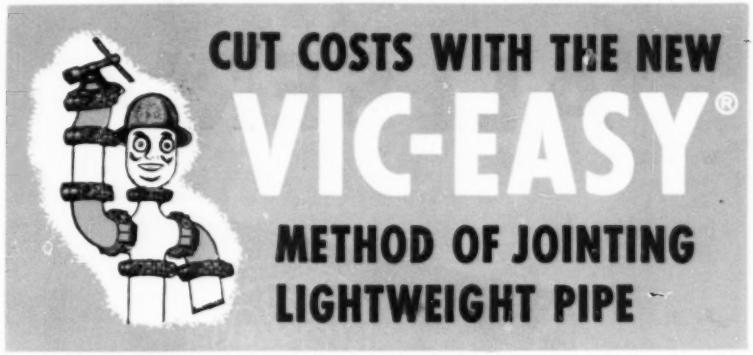
DEPENDABLE, accurate line samples of steam for use in chemical or electrolytic conductivity analysis can be taken by inserting steam sampling nozzles across the diameter of a steam line. The pickup ports on the units face upstream. Ports are positioned so that sampling is proportionate to the entire cross section of the steam line. The nozzles, made with either threaded or weld connections, are available in all standard ASTM or ASME configurations, as well as in special designs to meet customer specifications. A wide choice of materials is available for fabricating the nozzles. *Trinity Equipment Corporation*, Cortland, N. Y.

SERIES 663 Dynamaster instruments are now offered in pneumatic transmitting models. The instruments—potentiometers, pyrometers, ac and dc bridges, and differential transformer receivers with pneumatic output—continuously transmit a 3- to 15-psig pressure signal.

The units are especially suitable for use with the manufacturer's Metagraphic pneumatic instruments. The Model 663 is easily adapted to ratio, cascade and computer-type control systems, and offers convenient plug-in attachment of the pneumatic line. Series 663 Dynamasters occupy the same panel space (approximately 5×5 inches) as the Metagraphic instruments, and dials and charts are consistent with the Metagraphic series. *The Bristol Company*, Waterbury 20, Conn.

SUITABLE for air, gas or liquid pressures in locations where explosive gases or vapors are present, a high-pressure control (type H98) is useful in ranges from 10 to 1700 psig, with a proof pressure of 2500 psig and a maximun pressure of 3500 psig. The device is calibrated, pressure settings being made by turning a knob against a dial. The setting may then be locked with an allen wrench. Having a cast iron base and an aluminum cover, the unit is suited for use in Class I, Groups C and D; Class II, Groups E, F and G; and Class III of the National Electrical Code. It weighs 8 pounds 7 ounces, and is available with many types of switches. *United Electric Controls Company*, 97 School Street, Watertown, Mass.

MITE 74 is a precision integral 3-way valve of compact size designed for pressure limit protection. The unit automatically trips on a decrease in instrument air signal, either to vent or to hold downstream air. The trip point is adjustable from 1 to 100 psig pressure. There is no bleeding of signal air before or after the action. The device can be reset after the signal pressure is restored to approximately 10 percent above trip setting. A remote pneumatic trip connection makes possible independent tripping from a remote point, or auto-



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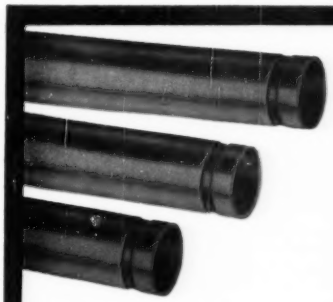
Now there's no need to buy overweight pipe. Thanks to Victaulic engineering, you can select lightweight pipe "job-rated" to your conditions and install it the *new VIC-EASY way*. You'll cut costs of pipe, transportation, and handling —you'll save from 30% to 60% in man-hour installation.



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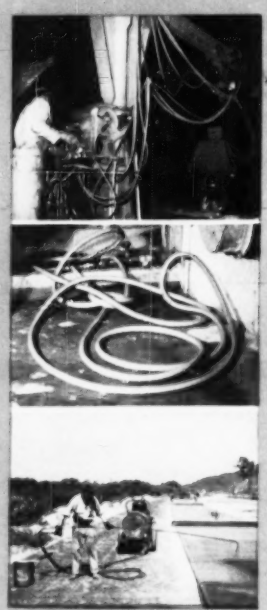
"ALLSERV" is a very flexible all-"Synplastic"® molded-and-braided hose, in one, two or three braid construction, with a tough wear-resistant red cover. Made in sizes ¼" to 1½" for working pressures from 200 lbs. to 300 lbs.



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matic tripping when an air signal exceeds a predetermined pressure. The instrument is said to be of sturdy construction. *George W. Dahl Company, Inc.*, 86 Tupelo Street, Bristol, R. I.

PNEUMATIC vibrators, as well as electric-, gasoline-, hydraulic- and steam-actuated ones, are catalogued in a 38-page brochure that provides engineering data, specifications and price lists on the Vibrolator line of vibration inducers. Fifty-two sizes are listed. Included is an instruction sheet about the manufacturers' CCVP series, illustrating how motor can be replaced in 3 minutes or changed from air to electric or hydraulic power source. Also shown is a new forced-air cooled Motomagnetic electric vibrator of adjustable frequency for use where difficult ambients are a problem. *Martin Engineering Works*, Neponset, Ill.

Quality Control In Making Trucks

THE CONTROLLED torquing of bolted truck motors and chassis components is a key factor in the efficiency and life of heavy-duty vehicles that operate under the most grueling conditions. White Motor Company has instituted a rigid quality control program on bolting operations at its truck manufacturing plant in Cleveland, Ohio. An integral feature of the project is the use of a torque wrench calibrator produced by Skidmore-Whilhelm Manufacturing Company in Cleveland.

In stepping up its bolting program, White first made a study of all the connections being made in its trucks. Using its own engineering data and information supplied by the Society of Automotive Engineers, torque standards were developed for every type of bolt and screw used, depending on the specific application being made.

The next step was to hold the torque limits within a close range on the actual assembly lines. A chart was prepared, showing each of the key operations, and the torque standard required for each.

How to make sure that the torque wrenches were delivering proper torque to the bolt was the remaining problem. The Skidmore-Whilhelm torque wrench calibrator selected has a range of 0 to 600 foot-pounds and provides a quick, simple method of testing the accuracy of torque wrenches. Its portability allows it to be moved quickly from one assembly area to another, as illustrated in the photograph, using the calibrator as a production tool rather than as a stationary unit that remains idle in the tool crib.

A rigid schedule is set so that certain wrenches are checked each morning. The cart-mounted calibrator is moved from one station to another, checking along the engine assembly lines, the dynamometer test bays, the rust-proofing area, and the rear axle, differential and front axle lines. The actual treating of the wrenches takes but a few seconds.

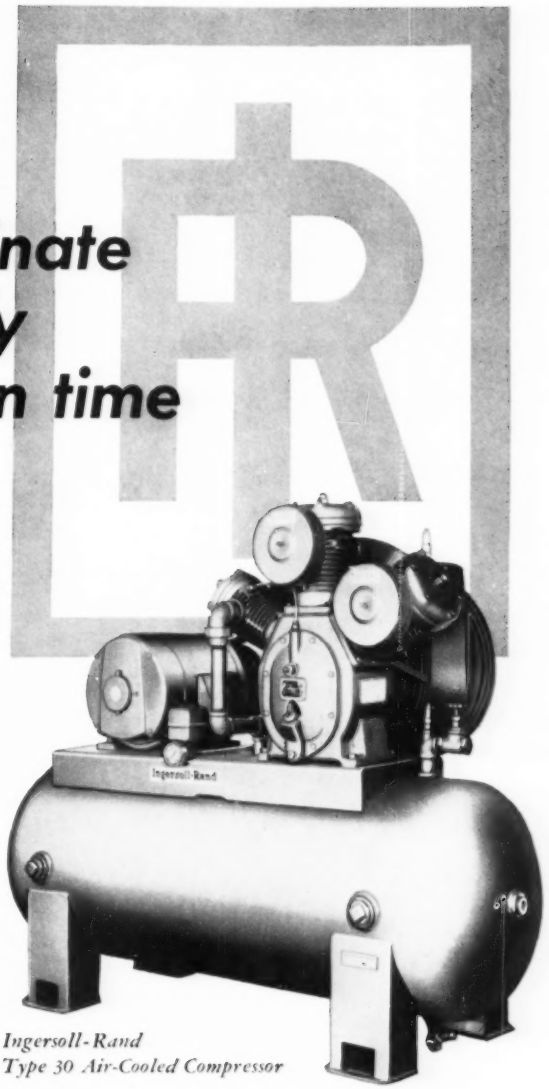
No special skills are needed to make the tests. The wrench is merely fitted into the coupling on the hydraulically operated calibrator, torque is applied, and the gauge gives a direct reading in foot-pounds of the torque being developed. This should correspond directly with the setting or reading on the torque wrench being checked.

The inspector uses a mimeographed sheet detailing each key bolting operation in his department. It indicates what torque should be applied. In a blank space next to the torque specification, he writes the actual torque figure indicated on the gauge. This sheet is returned each day to the inspector who can tell at a glance whether a torque wrench is registering properly.

White's standards program is part of the company's over-all requirements for strict quality control of all components and finished assemblies of its trucks and buses. The scope of this program may be seen from the fact that the company's required accuracy in torque varies from as low as 30 foot-pounds to as much as 1000 foot-pounds.

ON THE MOVE
This torque wrench calibrator is moved on a cart from one White assembly department to another for rapid daily inspection of torque wrenches. This portability makes it a production tool rather than allowing it to lie idle in the tool room.

eliminate costly down time



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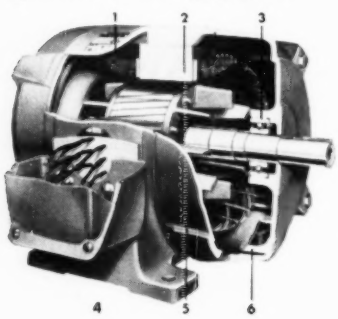

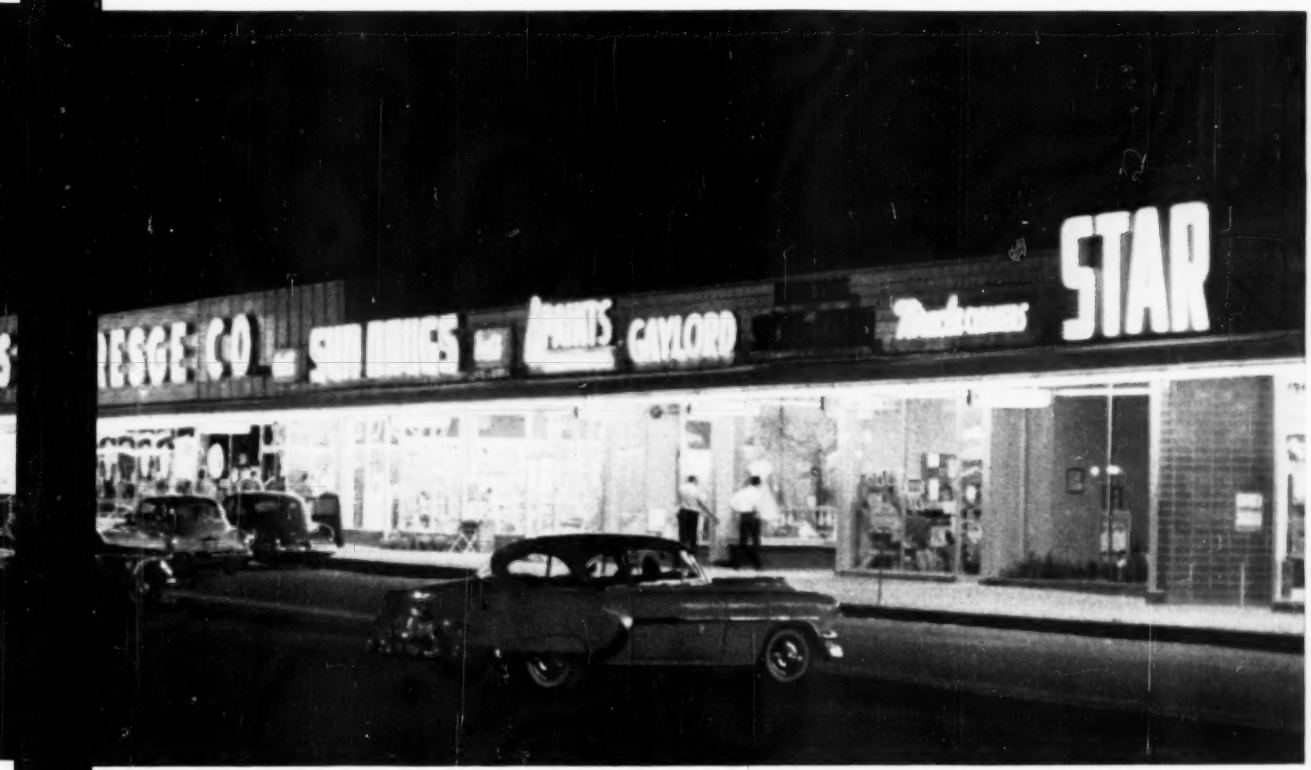

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Armorized frame provides rigidity to prevent armature misalignment even with heavy shaft loads . . . protects motor from physical abuse and contamination. Ventilation openings in the end brackets make the Westinghouse motor *completely* drip-proof, regardless of mounting position. Life-Line "A" 4-way sealed, prelubricated bearings keep grease in . . . dirt and water out . . . eliminate on-the-job greasing in out-of-the-way applications.

For complete information, call your local Westinghouse distributor or write Westinghouse Electric Corporation, 3 Gateway Center, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-22004

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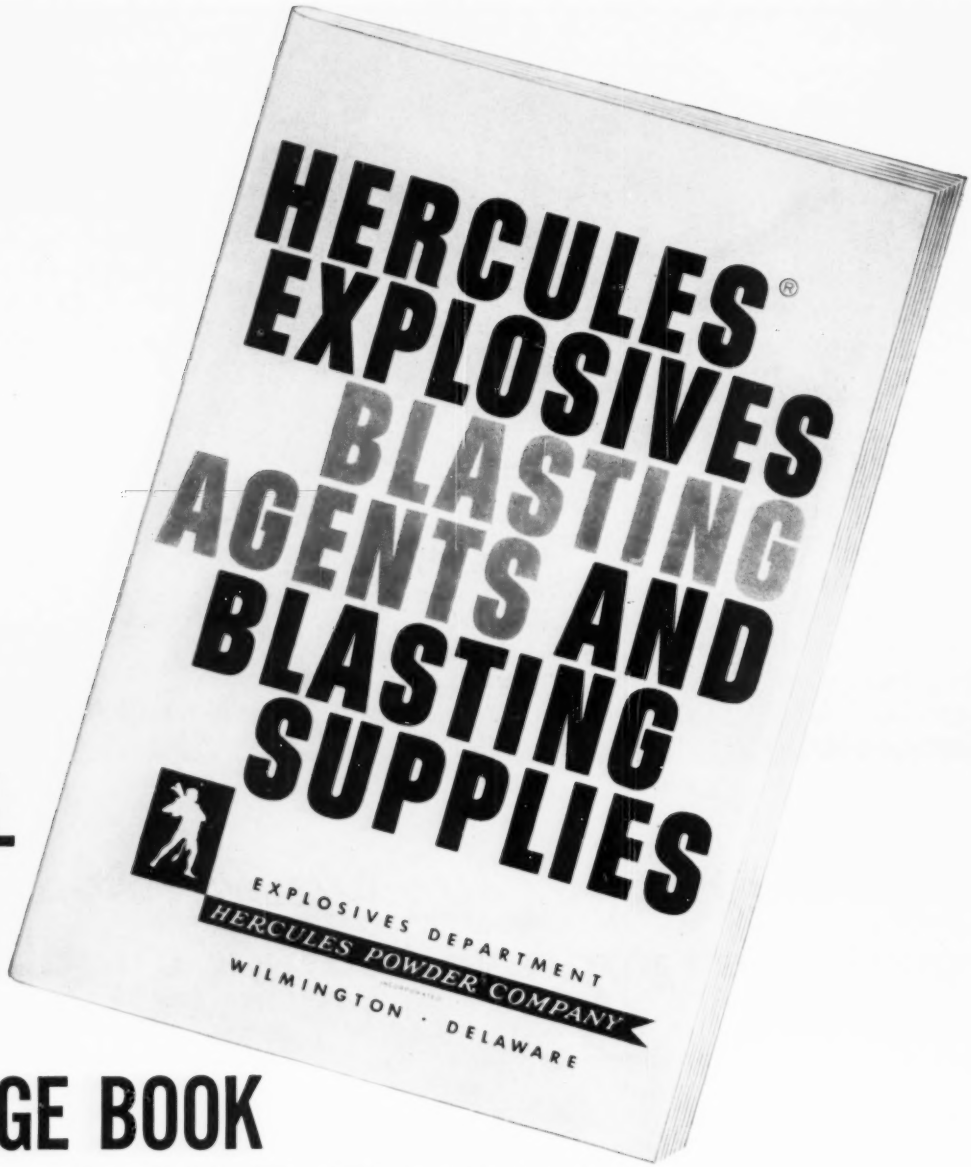

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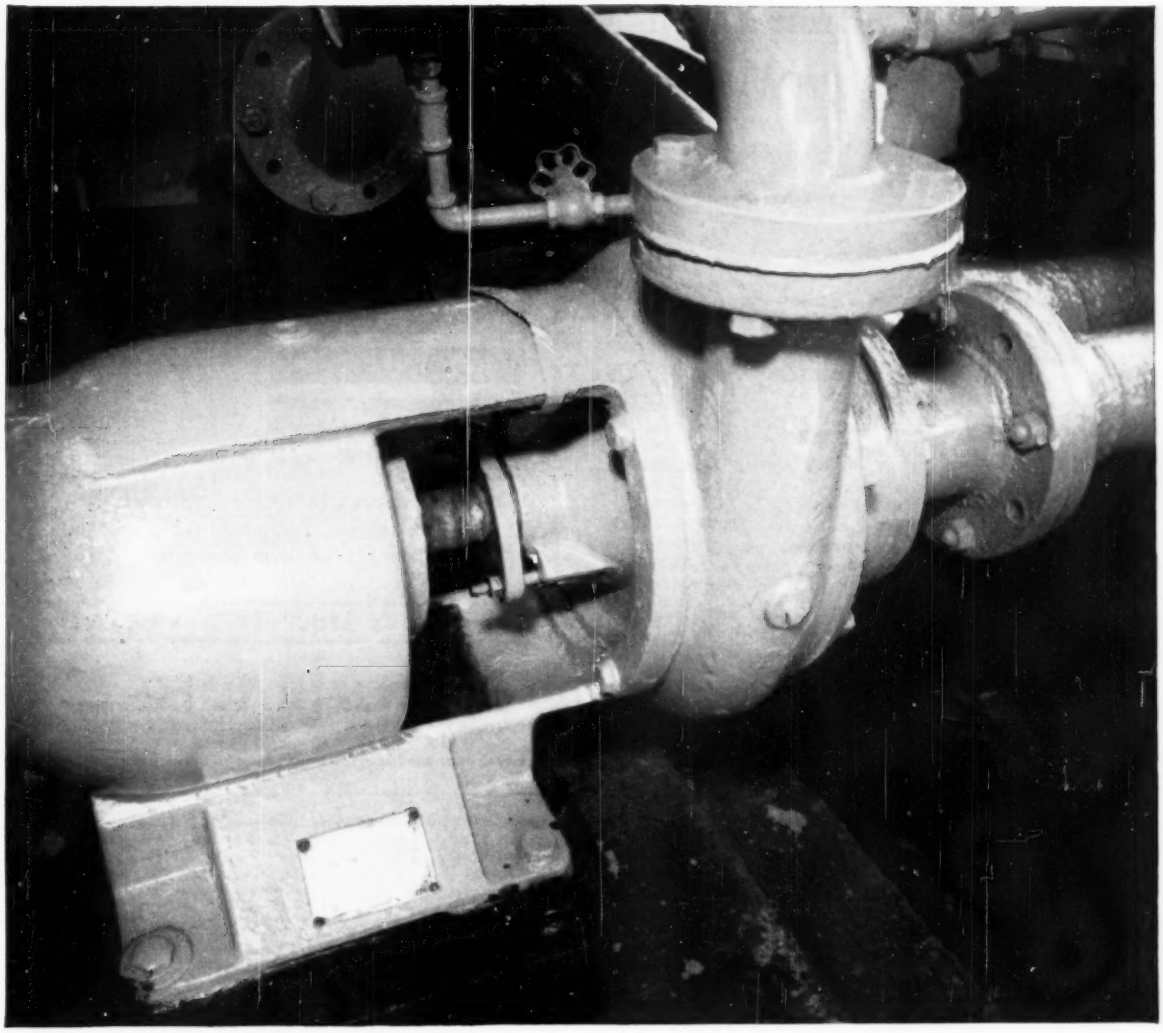

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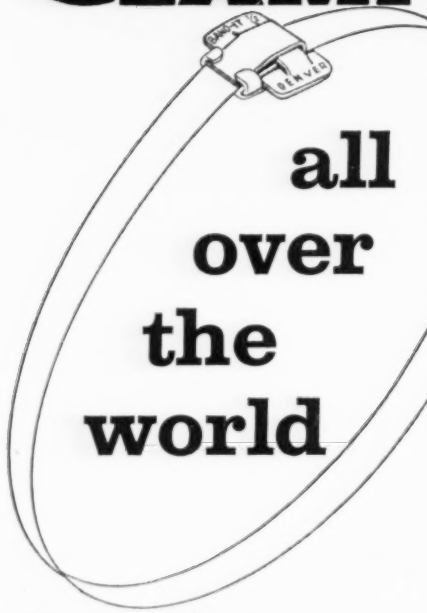

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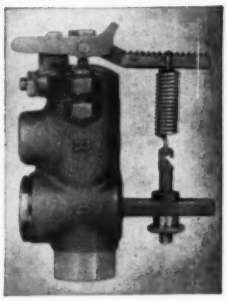

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FOR THE COMPLETE STORY, WRITE FOR BULLETIN A-8

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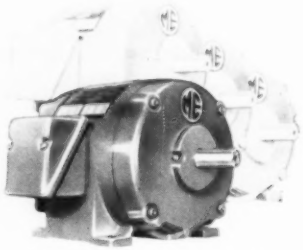

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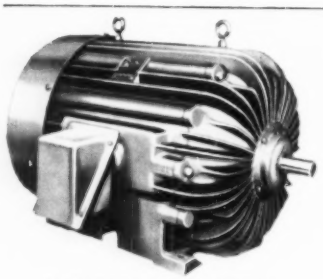

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Whatever your problem in flexible hose connections,

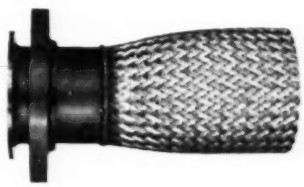
call the Man from Anaconda Metal Hose

Seamless: Of tin bronze (98¾% copper, 1¼% tin)—also corrugated stainless steel—in sizes ⅛" through 4" I.D. For conveying fluids, chemicals, etc., under conditions of flexure or vibration and to allow for misalignment. Reusable (mechanical type), soldered or welded fittings.

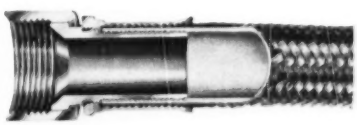
Stripwound: Constructed from brass, bronze, aluminum, galvanized or stainless steel. Sizes ½" through 8" I.D. A rugged type of hose for general service as steam, oil, water, particularly where the hose is handled manually. Fittings: soldered or heat-proof (packed-on).

Type UI: Interlocked unpacked hose in galvanized steel, stainless steel, aluminum, etc. Sizes through 8" I.D. For ventilating ducts, dust collection, engine exhausts, exhausts at grinding machines, bottle chutes, drain lines, protective casing for flexible hose assemblies.

Diesel: Heavy-duty steel exhaust and air intake hose. Sizes 2" through 16" I.D. Designed for rugged, heavy-duty use. Helical corrugations with open or closed pitch. Also in stainless steel (type Y-21) for corrosive applications.

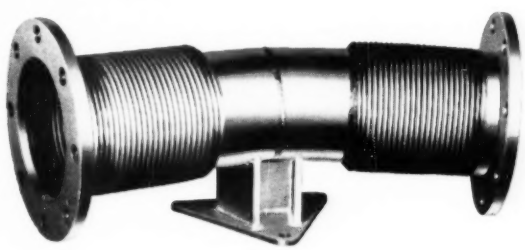


Flexpipe: Takes up travel in piping, connects misaligned ports, dampens noise and vibration in piping. Standard sizes and lengths. Available in bronze, stainless steel, steel; in sizes ¼" through 16" I.D. with NPT fittings, flanges or welding nipples.



Teflon* Anaconda flexible connectors of Teflon with stainless steel wire braid for use with pipe sizes from ⅛" through 1¼". Available in a wide variety of standard hose assemblies complete with fittings.

*Teflon is a DuPont trademark for its fluorocarbon resins.



AX Tubing: Large diameter tubing for big, tough jobs. Available in Type 321 Stainless Steel, and other metals and alloys. Sizes from 4½" through 14" I.D. Designed to handle axial and lateral movement—while conveying large volumes of liquids or gases—for bulkhead seals, etc.

FREE TECHNICAL SERVICE. Anaconda Metal Hose specialists are constantly working with design engineers on special flexible connectors and hose to meet new problems. Having broad experience working in stainless steel, other steel alloys, Monel, copper alloys, aluminum, and Teflon, they can save you considerable time and money in designing the flexible connector best suited for any of your jobs.

Our specialists are available to you through Anaconda Metal Hose representatives in leading cities—see listing "Metal Hose" in the Yellow Pages. Or write: Anaconda Metal Hose Division, The American Brass Company, Waterbury 20, Conn.

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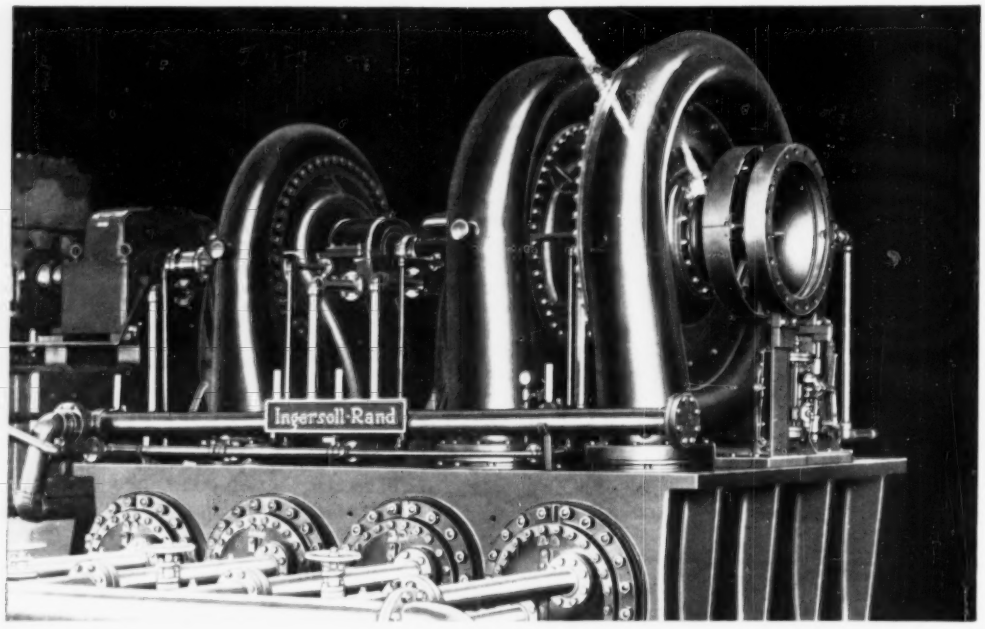


New 100 psi Centrifugal Air Compressor

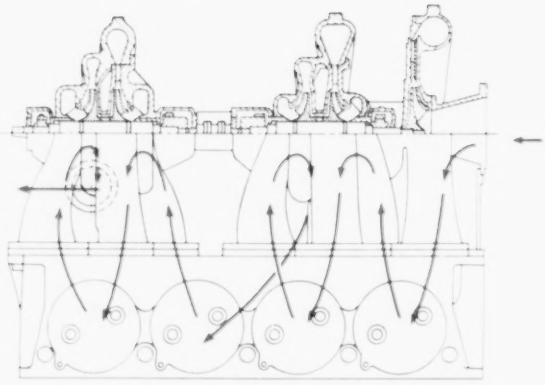
delivers up to 35,000* cfm

Five-Stage Intercooled Unit provides new efficiency and economy, with big savings in space and weight

THE Ingersoll-Rand CVM Centrifugal Compressor represents a new concept in the efficiency and economy of large-capacity air compression in the 100-125 psi range. With five compression stages and intercooling between each stage, it approaches the ideal *isothermal design*, delivering more air per horsepower than any other type of multi-stage centrifugal compressor.

The five impellers are mounted on two shafts, with two impeller pairs back-to-back to minimize axial thrust. The short shaft construction permits operation below first critical speed, minimizing vibration and extending the life of bearings and seals. The water-cooled intercoolers are integral with the machine base, have all water connections on the same side, and can be cleaned while the compressor is in operation.

The CVM Centrifugal Compressor is available in ratings to 35,000 cfm for discharge pressures to approximately 125 psi. For further details, see your I-R representative or write to Ingersoll-Rand.



Side elevation drawing of a CVM Centrifugal Air Compressor with top half of casing sections cut away to show impeller arrangement. Arrows indicate air flow through impellers and intercoolers.

Ingersoll-Rand

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*Higher capacities available with other designs.

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